DIVERSIFICATION

AND

REAL EXCHANGE RATE HEDGING IN EQUITY HOLDINGS

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ABSTRACT

The purpose of this paper is to examine the allocation of cross-border equity holdings and provide evidence that investors use equities to hedge real exchange fluctuations. The famous Backus-Smith (1993) condition, that relates the real exchange rates and relative consumption, is utilized in a two-country endowment economy introduced by Coeurdacier and Gourinchas (2009), in this case however, only stocks are traded. An important relationship between the real exchange rates, relative returns and equity positions is uncovered and subsequently incorporated into a gravity model developed by Coeurdacier and Guibaud (2011). Based on the uncovered relationship a new explanatory variable representing the correlation between the changes in real exchange rates and excess returns is utilized as a measure of the variation in bilateral equity holdings. If negative correlations imply home bias and positive correlations foreign bias, then given the particular market characteristics, the model measures whether investors hold equities to hedge the fluctuations in real exchange rate returns to smooth consumption. Although the primary results confirm the proposition, the findings vary with respect to the specifications included, and more empirical testing should be conducted.

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Table of Contents

Tables:

1. INTRODUCTION

1.1 Introduction

Over the last couple of decades a puzzling trend of portfolio home bias has been increasingly addressed by the international finance literature. The home bias can be described as investors' tendency to hold most of their financial wealth in domestic assets, despite the strong evidence suggesting that international portfolio diversification minimizes the overall portfolio risk by offering a wider range of opportunities. In the past, such biased behaviour was justified by informational asymmetries and the lack of access to foreign markets. Nowadays, with growing financial integration among countries, increased market globalization and more reliable information transfers we should observe a substantial decrease in the number of under-diversified portfolios. Nevertheless, there has been little change in the reallocation and rebalancing of investment allocation. The share of portfolio held in domestic equities is still very high, for most countries, with an average of 70 percent.[1] Although, the benefits of diversification are well known and acknowledged by investors, there is no uniform agreement as to why most investors still reveal a strong preference for domestic equities and choose to under-diversify.

Economic theory and empirical research suggest that investors, who wish to diversify, must look for markets that exhibit low or negative stock market return correlations with the home economy (Coeurdacier and Guibaud (2011)). Such correlations can ensure that negative returns on home equity will be compensated by positive returns abroad and vice versa. The fundamental question, then, is whether investors diversify their portfolios properly by allocating investments such that domestic and foreign returns are not positively correlated or only modestly correlated. Some of the empirical studies such as the one by Coeurdacier and Guibaud (2011) argue that this is indeed the case, whereas Baxter and Jermann (1997) argue that a typical investor is still very far from holding a truly diversified portfolio.

Diversification smoothes out portfolio returns when the performance of the domestic economy is poor and the foreign market is doing well. It can be also used for hedging country

[1] See the review in Coeurdacier and Guibaud (2011)

specific risk such as the uncertainty associated with the volatility in real exchange rates. Therefore, the question can be posed as to why many investors choose to hold poorly diversified portfolios. The international finance literature provides several theories for explaining this phenomenon in portfolio allocation. One of the theories proposes that home bias has arisen as a result of extra difficulties associated with investing in foreign equities, such as legal restrictions[2] or additional transaction costs.[3] Recent studies point to transaction cost, geographical patterns, volatility in expected returns and behavioural motivations as explanations for the lack of diversification.[4] Faruqee, Li and Yan (2004) find market size, transaction and information costs as significant determinants of international equity holdings.[5] The authors find that investors in countries with higher market capitalisation tend to hold more equities abroad; on the contrary, investors affected by high transaction costs reduce such holdings. Coval and Moskowitz (1999) demonstrate that informational asymmetries driven by geographical proximity also play an important role. The authors indicate that greater distance between two countries is more likely to reduce bilateral equity holdings. Moreover, Strong and Xu (2003) uncover behavioural tendencies, such as significant relative optimism towards home equities, as a valid explanation for under-diversified portfolios. Other factors contributing to the high degree of home bias in portfolio allocation include the risk associated with holding equities abroad. Hau and Rey (2004) find evidence that investors rebalance portfolio allocations in order to reduce the exposure to exchange rate fluctuations. Also, Fidora, Fratzscher and Thimann (2007) demonstrate that differences in portfolio home bias are determined by the exchange rate volatility. All of the above explanations, despite the rapidly changing face of the international finance, simultaneously appear as valid justifications for under-diversified portfolios.

Following the international finance literature, this paper attempts to evaluate whether investors allocate their foreign equity holdings optimally when considering the different diversification opportunities. More importantly, focus is given to the appreciation or depreciation of the real exchange rates and the variability in the prospective equity returns. The approach is to

[2] Faruqee, Li and Yan (2004) find that general relaxation of controls on foreign portfolio investments did not decrease significantly the degree of home bias in over 20 countries they investigated.
[3] Additional information taken from: Investopedia.com. Retrieved on April 4, 2011, from http://www.investopedia.com/terms/h/homebias.asp
[4] Faruqee, Li and Yan (2004), Hau and Rey (2006), Portes and Rey (2005), Strong and Xu (2003)
[5] Faruqee, Li and Yan (2004) find these variables are able to explain over 80 percent of the variation in the cross-border equity holdings.

investigate whether investors use equities to hedge real exchange rate fluctuations when they choose between the various investment allocations. In theory equities can be useful in hedging the risk, however, in practice this may not be the case. The optimal hedging can be achieved by other means such as bonds, which are independent of real exchange rate fluctuations, or even forward contracts.[6] However, the main objective of this paper is to conduct empirical testing to specifically measure whether equities can be used to hedge real exchange risk.

Hedging can be described as a strategy that aims to reduce a specific risk. In this case, it is the risk associated with real exchange rate fluctuations. The real exchange rate is defined as the price of foreign relative to domestic goods and services. It is the price of a unit of foreign currency measured in units of domestic currency corrected for relative prices. Provided that real exchange rate fluctuations determine the relative cost of domestic consumption, the concept behind using equities to hedge for real exchange rate risk proposes that investors can choose cross-border equity holdings to offset fluctuations in the cost of consumption. Thus, investors can ensure smooth consumption by rebalancing portfolio allocations between domestic and foreign equities when the real exchange rate fluctuates. Thus, when the real exchange rate appreciates investors may prefer to hold equities that offer a higher pay-off when domestic consumption is more expensive: investors may choose to rebalance their portfolio allocations to hold more foreign equities, if they offer higher returns, and less domestic. Consequently, to analyze whether it is safer to invest domestically or diversify internationally, it is necessary to examine the simultaneous movement of the changes in real exchange rates and relative excess returns. A simple correlation between real exchange rate fluctuations and relative excess returns is utilized to investigate the hedging properties. Within the parameters of this investigation, positive correlations imply that investors should invest abroad, whereas negative correlations imply home bias. I propose that with an increase in the correlation between the changes in real exchange rates and the relative excess returns, cross-border equity holdings should increase as well. Thus, to properly hedge the risk associated with real exchange rate fluctuations, appreciation in the real exchange rate[7] accompanied by a fall in the relative excess returns should induce foreign bias; while, appreciation in the real exchange rate and a rise in the relative excess returns should induce home bias. I attempt to not only determine how much variability in

[6] Coeurdacier and Rey (2011)

[7] The numerical value of the real exchange rate goes down when the real exchange rate appreciates.

bilateral equity holdings can be explained by the correlation between the two variables, but also establish whether this particular relationship can be used in the support of proper international portfolio diversification and as evidence for using equities to hedge real exchange rate risk. This, to my knowledge, has not been done in the recent empirical literature.

1.2 Overview

As a basis for my studies I utilize a gravity model developed by Coeurdacier and Guibaud (2011) and, in addition, investigate the contribution of the new correlation variable. The model includes a set of gravity variables such as market capitalisation, stock market returns, GDP, total trade and geographic proximity. Variables that control for country fixed effects are also included.[8] Ordinary least squares estimation is applied to measure the contribution and relevance of each variable in explaining the variation in bilateral equity holdings. The first section of the empirical methodology attempts to replicate the results obtained by Coeurdacier and Guibaud (2011) for a sample period 2001 to 2005.[9] As I will later show, although the estimates are close to those obtained in the original model, there is some discrepancy in the estimated coefficients. This variation is likely a result of using different data sources from those used by the authors. Following Coeurdacier and Guibaud's (2011) methodology, a two stage least squares estimation is applied to implement an instrumented variable. This approach is applied because the model suffers from misspecifications due to the correlation between stock market correlations and the disturbance term which arises from the simultaneous estimation of bilateral equity holdings and stock market returns in equilibrium. Furthermore, both of these variables depend on the level of financial integration between the countries. Coeurdacier and Guibaud (2011) use past correlations 1950 to 1975 to remove this endogeneity bias. The authors instrument current stock market correlations with past correlations. The IV- estimation is implemented to account for the level of financial integration that directly affects stock market returns and bilateral equity holdings and to measure the proper impact that stock market correlations have on cross-border holdings. After introducing the instrumented correlations into

[8] Country fixed effects refer to source and destination country dummies.

[9] Some of the investigated countries belong to the European Union, thus the exchange rate was fixed for those pairs of source and destination countries. I control for this by including a currency dummy. Later, recommendations are put forward to split the sample, exclude the Euro Zone countries and re-estimate the regressions.

the gravity model, Coeurdacier and Guibaud (2011) uncover a negative relationship between bilateral equity holdings and stock market correlations. Their findings imply that investors, who wish to diversify portfolio allocations, look for foreign markets that exhibit low, no or negative correlation with the home economy. However, the implemented IV- approach does not work well with the data set available for this analysis. The empirical methodology in this paper is constrained by a subset of past stock market returns for period 1970 to 1980. This subset for past correlations, although taken from a time period before the stock market liberalization, provides contradicting results. Given the different instrument, I do not obtain the same results as Coeurdacier and Guibaud (2011) in the second stage of the least squares estimation, and therefore, I do not incorporate the IV- approach in the final model. In the next step, the sample size is expanded to include years 2001 to 2008 and the new correlation variable is added to the earlier developed gravity model. Although the instrumented variable is not utilized, the model appears to work well. In addition, after including the double fixed effects, the model suggests that when investors choose to diversify their portfolio allocation, they do not only pick foreign equities that are characterized by low stock market correlations with the domestic equities but also properly use equities to hedge real exchange rate fluctuations. When the correlation between real exchange rate fluctuations and relative excess returns is negative (when it is safer for investors to invest domestically) the model suggests that investors would decrease their foreign equity holdings. Whereas, when the correlation is positive (when the proper way to hedge the risk is to diversify internationally) the model suggests that cross-border equity holdings would increase. Therefore, the conclusion is that investors hedge real exchange rate risk with equities to smooth consumption.

The paper is constructed in the following way: Section 2 includes the literature review; Section 3 looks at the theoretical motivation behind this paper; Section 4 delivers methodology and data construction techniques; Section 5 looks at replicated results and the contribution to the model; Section 6 includes discussion of the results, future recommendations and conclusions. There are also five appendixes: Appendix I includes the mathematical framework behind the theoretical model; Appendix II lists source and destination countries as well as small-sample countries; Appendix III includes 1999 conversion rates for Euro zone countries (national currency versus the Euro); Appendix IV provides regression results (sample 2001-2005) for the gravity model in equation (26) – Table 5, the IV-estimation in equation (27) – Table 7, and

equation (28) which represents the gravity model with the instrumented correlations – Table 8. The section also includes results for the gravity model in equation (26) applied to small-countries sample – Table 6, and descriptive statistics for chosen variables (bilateral equity holdings, distance, exports and imports, stock market correlations, 1970-80 stock market correlations); Appendix V includes results for regressions in equation (29) – Table 10 (sample 2001-2008) and descriptive statistics for the same set of variables as in Appendix IV.

2. LITERATURE REVIEW

Literature findings on home bias, diversification motive and international equity allocation are extensive, however, not always conclusive or supportive of each other. Home bias in portfolio allocation has been attributed to various determinants such as transaction cost, informational asymmetries and geographical patterns. Chan, Covrig and Ng (2005) examine mutual funds from 26 countries to measure investment allocation across 48 foreign and domestic equity markets while taking into consideration the impact of language, distance and transaction cost on investment allocation. The authors find that, for pairs of source and destination countries, a destination country that is more isolated and has a different language will have less foreign investment (source country investment). On the contrary, more developed countries accompanied by lower transaction costs have more foreign investors. Chan, Covrig and Ng (2005) do find that all 26 countries exhibit higher than anticipated home bias. Similarly, Obstfeld and Rogoff (2001) focus on international trade costs (transport costs, tariff and non-tariff costs, exchange rate risk) to explain a number of international puzzles pertaining to home bias. Their findings indicate that trade costs are important in determining portfolio bias, however, they are insufficient. Other benchmarks such as informational asymmetries and legal restrictions are essential as well. Similar attempt was undertaken by Portes and Rey (2005) who examine determinants of cross-border equity holdings. They use a gravity model which performs well in the trade in assets and the trade in goods. Distance, market size (expressed as market capitalisation) and efficiency of the transactions technology are all found to be good determinants of international equity flows. The authors find that distance cannot be used as a proxy for transportation cost and that the effect of market capitalisation on equity holdings is close to one in elasticity, which is also supported by other studies in this field (Coeurdacier and Guibaud (2011)). Portes and Rey (2005) also find

a negative relationship between bilateral equity transactions and distance which, as they explain, comes from informational frictions. This contradicts the belief that investors prefer to invest in distant countries since those are more likely to have markets that are not highly correlated. Portes and Rey (2005) findings support the diversification motive only when the authors control for informational frictions.[10] In fact, informational frictions are most relevant when it comes to determining the geographical distribution of cross-border equity flows.

Previous studies also indicate that home bias in equities can be attributed to fluctuations in real exchange rates. One of such empirical works is undertaken by Coeurdacier and Gourinchas (2009) who investigate the factors behind hedging real exchange rate risks. If returns on domestic equity increase when the real exchange rate appreciates, then investors should hold more domestic equity since it provides a proper hedge against real exchange rate risk.[11] Coeurdacier and Gourinchas (2009) consider two types of hedging the real exchange rate risk: relative bond returns, and relative equity returns. The authors show that international bonds provide good hedge for the real exchange rate fluctuations while equity hedging has little or almost no effect.[12] This result comes from the fact that relative bonds returns are positively correlated with the real exchange rate fluctuations. Consequently, equity positions hedge sources of risk that are not related to the real exchange rate fluctuations.

A slightly different approach in the international finance literature is used by van Wincoop and Warnock (2006) who use a covariance-variance ratio to measure home bias in equity. The proposed ratio takes the form in which the covariance between relative excess returns and change in real exchange rates is divided by the variance of the relative excess returns. The authors show that portfolio home bias in equity markets depends on this ratio, especially, when considering changes in the inflation rate due to the real exchange rate fluctuations. Such changes affect investors' decisions with respect to the distribution of their portfolio in times of inflation uncertainty. Van Wincoop and Warnock (2006) also find that in a general equilibrium setting the ratio is too low to explain home bias in equity holdings when they examine US versus

[10] Information variables include: telephone call traffic that measures total telephone call traffic between two countries; the number of branches in the destination country; and the degree of insider trading in the stock market of the destination country.
[11] As shown by the Backus-Smith Condition (1993), Appendix I.
[12] Here the coefficient on relative bond returns is close to one for all countries and significant, whereas the coefficient on the equity returns is close to zero and it is insignificant.

the rest of the world.[13] In a separate study, van Wincoop and Warnock (2009) also consider the effect of trade costs on the degree of home bias in portfolio allocation. They indicate that the optimal hedge of the real exchange rates depends on the correlation of asset returns with real exchange rate fluctuations. Again, they use the same covariance-variance ratio. The uncovered home bias linked to the real exchange rate hedge is lower than the one reported in other empirical studies that they examined. Also, when van Wincoop and Warnock (2009) condition real exchange rate on nominal exchange rate the data is much less volatile and the real exchange rate seems to be uncorrelated with the relative excess returns. Therefore, they conclude that portfolio home bias in equity is close to zero when considering the real exchange rate hedging after controlling for nominal exchange rate changes.

Coeurdacier (2009) looks at home bias in domestic consumption and portfolio composition. Empirical results imply that if countries are more open to trade in goods then they should have more internationally diversified portfolios. When measuring the allocation of cross-border equity holdings, the author indicates that it is important to consider the correlation between relative returns and real exchange rates. Coeurdacier's findings suggest that trade costs can increase portfolio home bias mainly when other factors contribute as well. Real exchange rate fluctuations lead to higher home bias in equities, which also increase with higher trade costs. Hau and Rey (2006), on the other hand, analyse exchange rate dynamics and equity flows. They examine correlation between excess returns on foreign equity, which is expressed in local currency, and corresponding exchange rate returns. This correlation turns out to be negative[14] which, as Hau and Rey (2006) explain, contradicts the common belief that strong equity markets are accompanied by real exchange rate appreciation. The negative correlation implies lower risk associated with foreign investment since negative returns on foreign equity are balanced by positive returns on exchange rates and vice versa. This insurance against return fluctuations reduces home bias. Fidora et al. (2007) analyze the importance of exchange rate volatility when determining the composition of portfolio holdings for different countries with various degrees of home bias. Fidora et al. (2007) use a form of CAPM, international capital asset pricing model,

[13] This includes 21 industrialized countries.

[14] Hau and Rey (2006) define the exchange rate as the units of foreign currency per units of domestic currency and measure equity flows in foreign currency terms. For the purpose of this paper the exchange rate is defined as the units of domestic currency per units of foreign currency. Therefore, the correlation would be positive if applied the later definition of the exchange rate.

and include volatility of real exchange rates as measured by deviations from purchasing power parity.[15] Their findings indicate that when volatility in local currency return is low then home bias in assets is higher. Moreover, the volatility in real exchange rate can explain about 20% of the variation in cross-country home bias, which means that a reduction in volatility in real exchange rate to zero volatility would reduce home bias in equity by 20% (or by 60% in bonds). This contribution is very important since it highlights the importance of controlling for changes in real exchange rates when analyzing home bias in portfolio allocation.

The fundamental methodology for this paper is derived from the empirical paper by Coeurdacier and Guibaud (2011) which I used as a starting point for my investigation. Coeurdacier and Guibaud (2011) use a gravity model to examine the contributions from various gravity and control variables in explaining the variation in cross-border equity holdings. They analyze a number of source and destination countries and variables that include data on market capitalization, stock market returns, GDP per capita ratio, distance, export and imports. Additional variables include a number of dummy variables, country and period fixed effects. The methodology involves regressing bilateral equity holdings on stock market correlations, market capitalisation and other gravity variables. Coeurdacier and Guibaud (2011) try to investigate whether investors properly diversify portfolio allocations by measuring the effect of stock market returns on bilateral equity holdings. The initial results imply that there is little evidence in support of the diversification theory. The authors find that for pairs of source and destination countries, more financially integrated markets will also have higher cross-border equity holdings. Coeurdacier and Guibaud (2011) argue that this first model is misspecified. Portfolio holdings and stock market returns are jointly determined in equilibrium, where both variables depend on the level of financial integration of the countries. Coeurdacier and Guibaud (2011) try to remove that positive endogeneity bias by using a new variable that comes from instrumenting current stock market correlations with past correlations. When using the instrumented correlations they are able to remove the endogeneity bias and reverse the sign of the estimated coefficient. This negative relationship between stock market correlations and bilateral equity holdings supports the argument that international portfolio allocations are to some degree affected by the

[15] The absolute purchasing power parity doctrine states that the general price level converted to a common currency should be the same in every country. Source:Copeland, Laurence. Exchange Rate and International Finance. Edinburgh Gate, England: Pearson Education Limited, 2008.

diversification motive. Although, the home bias in equities studied by Coeurdacier and Guibaud (2011) is very high for all countries, those investors who decide to diversify internationally do it properly.

3. THEORETICAL MOTIVATION

3.1 Motivation

Previous research indicates that stock market correlations play an important role in explaining the allocation of foreign equity holdings.[16] The economic theory suggests that the higher the stock market correlations between a domestic and a foreign market, the less foreign equities domestic investors should hold in that country. Such an approach to investment allocation ensures that negative equity returns in the home economy will be compensated by positive returns abroad and vice versa. However, bilateral stock market correlations alone do not determine the proper way of international portfolio diversification. Investors also need to consider real exchange rate fluctuations that determine the relative cost of consumption. The real exchange rate fluctuates in response to the changes in relative prices between countries.[17] When the domestic currency appreciates, home consumption becomes relatively more expensive and real exchange rate declines. When foreign currency appreciates, home consumption becomes relatively less expensive and real exchange rate rises. Therefore, in order to keep the optimal level of consumption, investors need to insure against the possible changes in the real exchange rates.[18] This is where the idea of using equities to hedge for real exchange rate risk is proposed. In theory, equities may be useful in hedging the real exchange rate risk, however, in practice, this may not be the case. Equities may offer poor hedging properties because even when the return earned is high, it may not be enough to compensate for the risk associated with real exchange rate fluctuations. Also, to avoid the risk associated with real exchange rates, investors may prefer to hold forward contracts or international bonds instead. However, the objective of the paper is to

[16] See the review in Coeurdacier and Guibaud (2011).
[17] Real exchange rate (RER) is the price of foreign relative to domestic goods and services. It is the price of a unit of foreign currency measured in units of domestic currency corrected for relative prices: Laurence Copeland's: Exchange Rates and International Finance. Edinburgh Gate, England: Pearson Education, 2008.
[18] This is true in the context of the theoretical model in this paper.

specifically provide empirical evidence whether equities can be used to hedge the real exchange rate risk.

Let's assume that the real exchange rate appreciates (its numerical value decreases). In such a case, the domestic consumption is relatively more expensive. Provided that the domestic equity returns are higher than the returns abroad, investors should invest more in domestic equities and less in foreign given that investors want to hold equities with a higher return in times when domestic consumption is more expensive.[19] However, if the domestic returns are lower then investors should diversify internationally. Therefore, by rebalancing portfolio allocations investors can hedge real exchange rate fluctuations to smooth consumption. For the purpose of this paper, the correlation between the real exchange rate fluctuations and relative excess returns is introduced to analyze whether it can help to explain the allocation of foreign equity holdings and provide evidence that investors use equities to hedge real exchange risk when trying to smooth the level of consumption. For this investigation, positive correlations imply foreign bias and negative correlations imply home bias. Therefore, with an increase in the correlation between the changes in real exchange rates and relative excess returns, bilateral equity holdings should increase as well (thus the coefficient should be positive).

The idea that the relationship between real exchange rates and relative consumption exists is intuitively appealing since foreign and domestic consumption should depend on relative prices (the real exchange rate). Exchange rates are very volatile and may impose high risk on domestic investors who chose to invest abroad. However, in practice, consumption cost does not change as much as relative prices. The economic theory that relates to international business-cycle models predicts that the real exchange rate and relative consumption should be perfectly correlated, where the correlation is close to unity. Thus, the more volatile the relative consumption, the more volatile are the relative prices. However, Backus and Smith (1993)[20] observed that the correlations between the real exchange rates and relative consumption are

[19] This is true if the changes in the real exchange rate are driven by inflationary differential between the countries, and not the nominal exchange rate.

[20] Backus and Smith (1993) examined the contribution of non-traded goods in explaining various puzzles that related to: large and persistent deviations from PPP; and imperfect correlations in aggregate consumption across countries. What the authors find is that, in theory, there is positive correlation between real exchange rates and consumption ratios for pairs of countries, however, in practice there is little evidence of such a relationship. Concluding on their model with one traded, and one non-traded good, they indicate that non-traded goods do not play a central role in accounting for this anomaly.

either zero or negative, which contradicts the economic theory. Hess and Shin (2010) tried to explain this anomaly by decomposing the real exchange rate into the nominal exchange rate and the inflationary differentials. They found bilateral inflation differential, and not the nominal exchange rate, to be positively correlated with bilateral consumption. Furthermore, if there was no fluctuation in the nominal exchange rate, the correlation between the real exchange rate and relative consumption would be positive, but still low. Consequently, the nominal exchange rate was found to create the Backus-Smith puzzle. Therefore, if the real exchange rate risk is due to the nominal exchange rate risk then hedging could be achieved by using bonds or forward contracts. In this case equities, as a mean of hedging, are examined.

In this paper I apply the Backus-Smith (1993) condition that relates the real exchange rate to the relative consumption, and introduce a two-country endowment economy similar to the one introduced by Coeurdacier and Gourinchas (2009). For the purpose of this paper, households trade only stocks. Also, households allocate their entire endowment to equities and face only a supply shock and no demand shock. Next, the uncovered relationship between the real exchange rates and the relative equity returns is used in a gravity model, developed by Coeurdacier and Guibaud (2011), to test the proposition that agents use equities to hedge real exchange rate risk.

3.2 Model[21]

Consider an endowment economy with two periods t=0,1, and two symmetric countries, Home (H) and Foreign (F). Each country has a representative household that produces one differentiated good. Countries trade and consume both goods with a preference for the domestically produced good. In period t=0 consumers trade only stocks (no consumption, no output). In period t=1 country *i* receives stochastic endowment y_i, where $E(y_H)=E(y_F)=1$.[22]

Both countries share the same CRRA utility function (Constant Relative Risk Aversion):

$$U_i = E\left[\frac{C_i^{1-\sigma}}{1-\sigma}\right], \quad (1)$$

[21] The model is borrowed from Coeurdacier and Gourinchas (2009). It is modified to consider only trade in socks. Also, the assumption that there is a portion of endowment that is not capitalized is dropped, thus δ=1. The mathematical framework for this model is provided in Appendix I.

[22] E is the conditional expectation operator. Also, in period t=0 expectations for output in period t=1 are normalized to 1.

where U represents utility, C is the aggregate consumption and σ>1 is constant and represents the coefficient of relative risk aversion. The aggregate consumption index is given by CES (Constant Elasticity of Substitution):

$$C_i = [a^{1/\varphi} c_{ii}^{(\varphi-1)/\varphi} + (1-a)^{1/\varphi} c_{ij}^{(\varphi-1)/\varphi}]^{\varphi/(\varphi-1)}, \quad (2)$$

where $i \neq j$ and c_{ij} is the consumption of good j by country i, φ is the elasticity of substitution between good i and j, and $a \in [\frac{1}{2}, 1]$ represents the share of consumption spending devoted to the domestically produced good with home bias in preferences for $a \geq 1/2$ (and a=1/2 represents identical preferences for both, home and foreign goods).

The corresponding price index is:

$$P_i = [a p_i^{1-\varphi} + (1-a) p_j^{1-\varphi}]^{1/(1-\varphi)}, \quad (3)$$

where i, j = F, H, and $i \neq j$.

At time t=1, when a shock is realised, household i maximizes utility U_i given the following budget constraint where I represents income: $P_i C_i = p_i c_{ii} + p_j c_{ij} \leq I$.

By solving the given Lagrangian for c_{ii} and c_{ij}:

$$L = \left[\frac{C_i^{1-\sigma}}{1-\sigma}\right] + \lambda_i \left[P_i C_i - p_i c_{ii} - p_j c_{ij}\right], \quad (4)$$

the following conditions are obtained:

$$c_{ii} = a \left(\frac{p_i}{P_i}\right)^{-\varphi} C_i \quad \text{and} \quad c_{ij} = (1-a) \left(\frac{p_j}{P_i}\right)^{-\varphi} C_i \quad (5)$$

The resources constraint is given by:

$$c_{ii} + c_{ji} = y_i \quad (6)$$

Define:

$$q \equiv \frac{p_H}{p_F} \quad (7)$$

Where q is the Home terms of trade: it is the relative price of the home good in terms of the foreign good.

The entire endowment is allocated to stocks. A country's holdings of domestic stock is denoted by S where $S=S_{ii}+S_{ji}=1$. The budget constraint for a household at time t=0 is: $p_s(S_{ii}+S_{ij})=p_s$ (with S_{ij} as country's i shares of stock j); the market clearing condition for stocks: $S_{ii}+S_{ji}=1$. Thus, if S>1/2 then there is home bias in the stock market (due to symmetry and because $S_{ii}+S_{ij}=1$ and $S_{ii}+S_{ji}=1$, under market clearing $S_{ij}= S_{ji}$ and thus $S_{ii}= S_{jj}$).

Use (6) for both countries:

$$c_{HH} + c_{FH} = y_H \text{ and } c_{FF} + c_{HF} = y_F \tag{6a}$$

Substitute (5) into (6a) and solve to get:

$$q^{-\varphi}\Omega\left[\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)\right] = \frac{y_H}{y_F} \quad \text{where} \quad \Omega\left[\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)\right] = \frac{1+\frac{1-a}{a}\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)}{\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)+\frac{1-a}{a}} \tag{8}$$

Now, given the fact that household *i* holds S shares of the local stock and (1-S) shares of the foreign stock, period t=1 budget constraint is:

$$P_iC_i = Sp_iy_i + (1\text{-}S)p_jy_j, \tag{9}$$

where p_iy_i is the dividend paid on the local stock, and p_jy_j is what is paid on the foreign stock. Applying this property to two countries and solving for the difference in countries' consumption gives:

$$P_iC_i - P_jC_j = (2S-1)\left(p_iy_i - p_jy_j\right) \tag{10}$$

Again, $q \equiv \frac{p_H}{p_F}$ is the relative price of the home good in terms of the foreign good. Let $y = \frac{y_H}{y_F}$ represent the relative output. Log-linearize ($\hat{x} \equiv \log\frac{x}{\bar{x}}$) the model around the steady state (ss): $q \equiv \frac{p_H}{p_F} = 1, y = \frac{y_H}{y_F} = 1, \text{and } \frac{C_H}{C_F} = 1.$

Let $RER = \frac{P_F}{P_H}$ be the real exchange rate defined as domestic price of the foreign good.

Thus,

$$\widehat{RER} = \widehat{\left(\frac{P_F}{P_H}\right)} \tag{11}$$

Use the price index (eq. (3)) and substitute it into eq. (11):

$$\widehat{RER} = \widehat{\left(\frac{P_F}{P_H}\right)} = -(2a-1)\hat{q} \tag{12}$$

By Backus-Smith Condition (1993) the optimality condition is the following:

$$-\sigma\left(\widehat{C_F} - \widehat{C_H}\right) = \widehat{\left(\frac{P_F}{P_H}\right)} = -(2a-1)\hat{q} \tag{13}$$

Provided that:

$$\frac{MU_F}{MU_H} = \frac{C_F^{-\sigma}}{C_H^{-\sigma}} \quad \text{and} \quad d\log\frac{MU_F}{MU_H} = d\log\frac{C_F^{-\sigma}}{C_H^{-\sigma}} = -\sigma(\widehat{C_F} - \widehat{C_H}),$$

where MU stands for the marginal utility of consumption. Thus, fluctuations in the real exchange rates are associated with the fluctuations in the aggregate consumption such that a decline in the real exchange rate (home currency appreciation) is related to the reduction in the relative consumption (the domestic consumption is more expensive, thus the domestic consumption falls relative to foreign), and vice versa.

Log-linearizing eq. (8) and substituting equation (13) for $\widehat{\left(\frac{C_F}{C_H}\right)}$ gives:

$$\hat{y} = -\varphi\hat{q} - (2a-1)\left(\varphi - \frac{1}{\sigma}\right)\widehat{\left(\frac{P_F}{P_H}\right)} \tag{14}$$

$$\text{Set} \quad \lambda = \varphi + (2a-1)\left(\varphi - \frac{1}{\sigma}\right)[-(2a-1)] = [1-(2a-1)^2]\varphi + \frac{1}{\sigma}(2a-1)^2$$

Thus $\hat{y} = -\lambda\hat{q}$ where λ represents output elasticity of trade.

The representative household in country i holds S shares of the local stock and (1-S) of the foreign stock, which pay respectively $p_H y_H$ and $p_F y_F$.

Thus, the relative equity return is:

$$\mathrm{Re} = \frac{p_H y_H}{p_F y_F} \tag{15}$$

Log-linearizing:

$$\widehat{\mathrm{Re}} = \hat{q} + \hat{y} = (1-\lambda)\hat{q} \tag{16}$$

This implies that for $\lambda>1$, an increase in relative equity returns is associated with worsening of Home's terms of trade; and for $\lambda<1$, an increase in relative equity returns is associated with an improvement in the terms of trade.

Log-linearize (10):

$$P_H C_H - P_F C_F = (2S-1)(p_H y_H - p_F y_F) \tag{10a}$$

This gives:

$$\widehat{P_H C_H} - \widehat{P_F C_F} = (2S-1)(1-\lambda)\hat{q} \qquad (17[\text{by } (16)])$$

Also (by (13)):

$$\widehat{P_H C_H} - \widehat{P_F C_F} = \left(1-\frac{1}{\sigma}\right)(2a-1)\hat{q} \tag{18}$$

Thus, by eq. (17) and (18):

$$S = \frac{1}{2}\left[\frac{\left(1-\frac{1}{\sigma}\right)(2a-1)}{(1-\lambda)} + 1\right] \tag{19}$$

Thus $\left[\frac{\left(1-\frac{1}{\sigma}\right)(2a-1)}{(1-\lambda)}\right]$ is the hedge component and:

$$S = \frac{1}{2}\left[1 - \left(1-\frac{1}{\sigma}\right)\frac{\mathrm{cov}\left(\widehat{\mathrm{Re}}, \widehat{\mathrm{RER}}\right)}{\mathrm{var}\left(\widehat{\mathrm{Re}}\right)}\right] \tag{20}$$

The above relationship is derived in Appendix I. It implies that when the covariance-variance ratio is negative, then S>1/2, and there is home bias in equity portfolio allocations. However, if the covariance-variance ratio is positive, then S<1/2, and there is foreign bias in equity positions.[23]

Therefore the optimal portfolio position is:

$$S = \frac{1}{2}\left[1 - \left(1 - \frac{1}{\sigma}\right)\frac{\sqrt{\operatorname{var}\left(\widehat{RER}\right)}}{\sqrt{\operatorname{var}\left(\widehat{Re}\right)}}\operatorname{corr}\left(\widehat{Re}, \widehat{RER}\right)\right] \tag{21}$$

In this particular model, the correlation between the real exchange rates and the relative returns is equal to -1[24] since there is only a supply shock, and no demand shocks. In a more realistic setting, there are both supply and demand shocks and the correlation would not be equal to -1, however, it would have the same sign as the covariance-variance ratio. Thus, one would expect this kind of a relationship (eq. (21)) to hold in a more complex model with supply and demand shocks, nevertheless, this assumption cannot be confirmed within this investigation. Moreover, using correlation, and not covariance makes this relationship easier to interpret. Thus, for the empirical testing in this paper, the correlation between the real exchange rates and relative returns is utilized into the model and not the covariance-variance ratio.

[23] The optimal portfolio allocation is appropriate only when the investor is sufficiently risk averse, that is, when σ>1.
[24] How to arrive at -1 is shown in Appendix I.

The following proposition is to be tested:

3.3 Proposition

The share of domestic (i) market wealth invested in a foreign (j) country equity is subject to the correlation between: the fluctuations in real exchange rates ($\widehat{RER}$) and excess in relative stock market returns ($\widehat{Re}$). This particular relationship is expected to be positive, that is, stronger positive correlation indicates that more equity is held abroad, whereas stronger negative correlation suggests that investors hold more domestic equity. Given that:

$$\textit{Relative Equity Return}_{ijt}=\widehat{Re}_{ijt}=\textit{Domestic Return}_{it}-\textit{Return on Foreign Equity}_{jt}, \quad (22)$$

$$\textit{Real Exchange Rate}_{ijt}=RER_{ijt}=RER[\tfrac{i}{j}]_t=\frac{\textit{National Currency per SDR}_{it}}{\textit{National Currency per SDR}_{jt}}*\frac{CPI_{jt}}{CPI_{it}}, \quad (23)$$

$$\widehat{RER}_{ijt}=Log(\frac{RER_t}{RER_{t-1}})_{ij}, \quad (24)$$

$$\text{and } corr(\widehat{RER},\widehat{Re})_{ijt}=\frac{cov(\widehat{RER},\ \widehat{Re})}{\sqrt{var(\widehat{RER})*var(\widehat{Re})}} \quad (25)$$

3.4 Elaboration

Table 1: Possible outcomes for the correlations between changes in the real exchange rate and relative excess returns.

	Real Exchange Rate	Relative Returns	Sign of the Correlation between the two Variables	Predicted Portfolio Allocation
Case 1	Decreases	Increases	Negative	Home Bias
Case 2	Increases	Decreases	Negative	
Case 3	Decreases	Decreases	Positive	Foreign Bias
Case 4	Increases	Increases	Positive	

The above table represents the possible outcomes for the correlations calculated between the two variables. As provided by the model, negative correlations imply home bias and positive correlations imply foreign bias. Diversification takes place when the correlations are equal to zero. The calculated values for the investigated correlations are the actual observations that will be used in the trade model adopted from Coeurdacier and Guibaud (2011) where the intention is to examine the relationship between the correlation variable and the bilateral equity holdings. The resulting coefficient will either support or oppose the later proposition. Also, when considering the negative correlations it is important to note that the more negative the correlation is in magnitude, the less foreign equity investors should hold. For example, if the correlation between a given source country and a destination country, say country A, is equal to -0.1, and correlation between the same source country but a different destination country, say country B, is -0.5 then domestic investors should hold more equity in country A, relative to country B. Consequently, the stronger the positive correlations between real exchange rate fluctuations and

relative excess returns, the more foreign equities domestic investors should hold.[25] The optimal strategy that should be applied by investors depends on the correlation between the real exchange rate fluctuations and relative equity returns. It is desirable to measure this particular correlation and its effect on bilateral equity holdings in order to determine whether equities are properly used to hedge real exchange rate risk to smooth consumption.

4. MODEL

4.1 Methodology

The methodology in this paper involves the analysis of how the allocation of bilateral equity holdings is influenced by the desire to hedge real exchange rate risk. The empirical approach is based on the gravity model implemented by Coeurdacier and Guibaud in "International Portfolio Diversification is Better than You Think" (2011). Following Coeurdacier and Guibaud (2011) a gravity model that examines the variability in bilateral equity holdings is utilized for a number of source and destination countries. The model is estimated by ordinary least squares (OLS) regressions that are applied to unbalanced panel data sets. The sample period includes years 2001-2008 and the frequency of the data is annual. The methodology involves regressing the logarithm of bilateral equity holdings on the logarithm of the product of countries' market capitalisation, stock market correlations and other gravity variables. Period fixed effects and regional dummies are included, as well as source and destination country dummies to control for countries' size and wealth. The important contribution to this model is the inclusion of a new variable, the correlation between real exchange rate fluctuations and relative stock market returns. The new variable can serve as an additional measure towards the proper international portfolio allocation. However, more importantly, its purpose is to provide insight into using equities to hedge for real exchange rate fluctuations.

Coeurdacier and Guibaud's (2011) gravity model provides a well defined estimation method for explaining the variation in the cross-border equity holdings. The model takes into account all of the natural control variables such as country geographic proximity, international trade and wealth. Coeurdacier and Guibaud (2011) demonstrate that the OLS estimation, used in

[25] This is true when countries are symmetric. For countries of different sizes this property may not work.

the model, is a valid method for testing the contribution and significance of each variable. The results obtained by the authors are in support of previous studies in that field and thus the model allows us to direct full attention towards the new variable, the correlation between real exchange rate fluctuations and relative excess returns, and its contribution in explaining hedging real exchange rate risk with equities.

4.2 Variable Structure

4.2.1 Bilateral Equity Holdings

Bilateral equity holdings represent the reported portfolio investment assets by country of a non-resident issuer: equity securities. The data is in current US dollars, and it is for years 2001 to 2008; the frequency is annual. The bilateral equity variable is the logarithm of the reported source country equity holdings in a destination country. Following Coeurdacier and Guibaud (2011) all reported zeros are replaced with 0.01[26] million. One important thing to note is that for some countries, especially Canada, there are negative values reported for bilateral equity holdings. The explanation given by IMF is that negative values represent short position in securities that resulted from the sale of securities acquired under repurchase agreements.[27] The negative values will be dropped due to the logarithmic transformation. The occurrence of the negative values is very low and therefore neglecting these observations should not affect the results. Also, a recommendation for future empirical testing proposed is to drop the reported zero-values and re-estimate the model. This would provide an appropriate check for robustness of the data and more profound insight into using equities to hedge real exchange rate risk.

4.2.2 Market Capitalisation

Market capitalization, which is also known as market value, is defined as the share price times the number of shares outstanding. The World Bank[28] stipulates that the listed companies must be domestically incorporated and must be listed on the country's stock exchange at the end of each

[26] As the IMF website informs, the reported zero values represent equity holdings between 0 and 500,000 US dollars. To be consistent with Coeurdacier and Guibaud's (2011) approach I replace those values with 0.1 million US dollars.

[27] Source: 8th Coordinated Portfolio Investment Survey 2008 (CPIS), July 2009. Retrieved from: http://www.gov.mu/portal/sites/ncb/fsc/download/GBCs1_CPIS08.pdf, on April 22, 20011.

[28] Information taken from: The World Bank Website. Downloaded on June 5, 2010 from http://data.worldbank.org/indicator/CM.MKT.LCAP.CD/countries/latest?display=default

year. Furthermore, the listed companies do not include investment companies, mutual funds, or other collective investment vehicles. Market Capitalisation is expressed in current U.S. dollars. The frequency is annual, and the data range includes years from 2001 to 2008. The variable representing the market capitalisation is the logarithm of the product of market capitalisation between a source and a destination country. The variable is: Log($(MktCap)_{it}$ *$(MktCap)_{jt}$), where i=1,2,...,27 refers to source countries, and j=1,2,...,41 refers to destination countries.

4.2.3 Stock Market Returns and Bilateral Correlations

Stock market returns and stock market correlations are calculated from stock market indices. Stock market index is generated from MSCI Barra website.[29] The data represents standard large and middle capitalisation[30] index and it is expressed in USD prices. The frequency of the series is monthly. The index availability starts on December 31, 1969. Coeurdacier and Guibaud (2011) use stock market index which begins in 1950s (source: Global Financial Data). The authors use 1950 to 1975 index values to introduce the instrumented variable. In this case, due to the lack of data availability, the instrumented variable will be based on index values between 1970 and 1980, which is provided for 18 countries only. To calculate stock market returns log first difference is applied to stock market index, that is, Log($\frac{S_t}{S_{t-1}}$). Stock market returns are used to calculate bilateral ten year rolling window correlations. The bilateral correlations are calculated between each source and destination country. This takes the following form: bilateral correlations for year t are calculated between one source and one destination country for years t-9 to t (inclusive), that is, $corr_t(Return_{(t-9,\,t)}^{s}; Return_{(t-9,\,t)}^{d})$. The panel data is for years 2001 to 2005, and then 2001 to 2008, however, to calculate the observations used in the panel data setting, the ten year rolling window technique is applied to data that starts in January of 1992. For Colombia, Israel, Peru and South Africa the availability of stock market returns starts in 1993, Morocco starts in 1995 and Nigeria in 2002. For the above mentioned countries the ten year rolling window correlations will be calculated as well, however, if the returns start in 1993, then the correlations will be only for years 2002 and up. Correlations for Morocco start in 2004, Nigeria is excluded. Thus, the ten

[29] The standard large and mid cap indices include large and mid cap segments and provide exhaustive coverage of these size segments. The MSCI website informs that to construct country indices all listed securities in the markets are identified; securities are free-float adjusted, classified w.r.t. GICS, and screened by their attributes.

[30] Middle cap is assigned to companies whose market value is between 2 and 10 billion dollars, Large cap is for companies worth more than 10 billion dollars. Source: Investopedia. Retrieved from: http://www.investopedia.com/ terms/m/marketcapitalization.aspon, on April 21, 2011.

year rolling correlations follow the pattern: 1992 to 2001 for year 2001, 1993 to 2002 for year 2002, ... , 1999 to 2008 for year 2008, etc.

4.2.4 Consumer Price Index (CPI)

CPI values are calculated as general price indices that cover most of the food items and other household expenditures. The base year of the index is 2005 and the frequency is monthly. There is no monthly CPI for Australia and New Zealand because CPI indices are reported quarterly in those countries. Therefore, these countries are excluded from the estimation once the new variable is added.[31] The relative CPI index is then used to arrive at the real exchange rate. Under specific circumstances, the relative export prices may provide a more reliable index since relative export prices indicate how much of the home consumption goods one would need to sacrifice to get foreign consumption goods. However, such approach is often believed to provide more of a measure of trade rather than a measure of the real exchange rate, thus, the consumer price index is applied.

4.2.5 Excess Returns

Relative excess return for year t is calculated as the difference between stock market returns in the source country and stock market returns in the destination country at time t, that is:

$$\widehat{\mathrm{Re}}_{ijt} = \text{Equity Return}_{it} - \text{Equity Return}_{jt}$$

4.2.6 Bilateral Real Exchange Rates

Real exchange rate represents the end of period national currency per SDR.[32] The frequency is monthly where the rates are in the form of the official, market or principal rates. For most countries exchange rates are the market rates. For other countries the rates are official or principal which may be different from market rates. Market rates are mostly determined by market forces. Official rates are determined by authorities. Principal rates (also secondary or tertiary rates) are listed for countries with more than one exchange rate system. Source for the

[31] This is done to make sure that the data used in the analysis is consistent across the sample.

[32] SDRs, or Special Drawings Rights, is an international reserve asset created by the IMF to supplement IMF's member countries' official reserves. The value of SDRs is based on a basket of four key international currencies and can be exchanged for other currencies. Source: IMF. Retrieved from: http://www.imf.org/external/np/exr/facts/sdr.htm on May 20, 2011.

data is IMF IFS[33]. For countries that joined the EU in year 2000, the national currency per SDR is not reported. In this case, the national currency per SDR from the Euro Area is used to convert the official rates from euro to the national currencies to get the missing data.

The national currency per SDR is not the bilateral exchange rate. To arrive at the nominal bilateral exchange rate it is necessary to divide national currency per SDR for a source country by the national currency per SDR for a destination country. To arrive at the real exchange rate, the consumer price index is used to adjust the nominal rates for inflation.

The real exchange rate, RER is:

$$RER[\frac{i}{j}] = \frac{\text{National Currency per SDR}_{it}}{\text{National Currency per SDR}_{jt}} * \frac{CPI_{jt}}{CPI_{it}}$$

Where i=1, 2,..., 27 for source countries, and j=1, 2, ..., 41 for destination countries. CPI for Australia and New Zealand are only reported quarterly, therefore these countries are excluded when adding the new variable. The frequency of the real exchange rate is monthly.

The new variable is the correlations between the change in the real exchange rates and the relative excess returns. To arrive at the fluctuations in the real exchange rates, the log first difference is applied. It takes the following form:

$$\widehat{RER}_{ijt} = \text{Log}(\frac{RER_t}{RER_{t-1}})ij$$

Relative excess returns are defined as the difference between the source and the destination country returns, that is:

$$\widehat{Re}_{ijt} = \text{Equity Return}_{it} - \text{Equity Return}_{jt}$$

The correlation is of the same form as the one applied to stock market returns, that is, the ten year rolling window correlations are calculated between the fluctuations in real exchange rates and the relative excess returns to give annual observations for years 2001-2008.

[33] International Monetary Fund, International Financial Statistics.

Therefore, the variable used in the analysis is:

$$\text{corr}(\widehat{RER}, \widehat{Re})_{ijt}$$

Using correlations and not covariance makes this variable easier to interpret. The correlation provides a measure of the strength of the relationship between the excess returns and the real exchange rates and its effect on the bilateral equity holdings. It will measure whether the two variables vary together or not. If the correlation for the excess returns and exchange rate is positive it means that the two variables varied together in the same direction from the means. If it is negative then the two variables varied in the opposite directions from their means. Also, the larger the correlation, the stronger is the relationship between the variables. For example, the covariance and therefore the correlation is positive if either there is a decrease in the real exchange rate and the equity returns in the source country are relatively lower, or an increase in the real exchange rate and the equity returns in the source country are relatively higher.

4.2.7 Expected Returns

Expected returns are based on the average monthly returns in the subsequent year, where returns for year t are calculated from the actual returns in year t+1.

4.2.8 Gross Domestic Product

The definition that the World Bank defines GDP as "the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources."[34] GDP is calculated at purchaser's prices and expressed in current U.S. dollars. It is converted from countries' own currencies using single year official exchange rates.[35] The website also explains that in few cases where the official exchange rate did not reflect the rate that was applied to the actual foreign exchange transactions, an alternative conversion factor was used.

[34] Definition extracted from The World Bank website. Retrieved on June 14, 2010 from http://data.worldbank.org/indicator/NY.GDP.PCAP.CD.

[35] The World Bank website explains that the official exchange rate, used in the conversion of the GDP in local currency to USD, represents the exchange rate that is determined by national authorities where the annual average is based on the monthly averages.

4.2.9 Gross Domestic Product per Capita

This variable is the GDP divided by midyear population. GDP per capita is in current U.S. dollars. The variable used is the logarithm of the product of a source and a destination country GDP per capita, $\text{Log}\left[\left(\frac{\text{GDP}}{\text{Capita}}\right)_{it} * \left(\frac{\text{GDP}}{\text{Capita}}\right)_{jt}\right]$.

4.2.10 Distance

Distance variable is defined as the distance between the largest city (the most populated city) of a source and a destination country. It is measured "as the crow flies" and expressed in kilometres. The logarithm of the distance is used thus the variable is: $\text{Log}(\text{ Dist })_{ij}$.

4.2 11 Bilateral Export and Import

This data set represents total exports to and imports from a destination country, given each source country. The frequency for this data set is annual and it covers years 2001 to 2008. It is expressed in current US dollars. To create the variable, the sum of export and import is divided by the product of countries GDP, and then the logarithmic transformation is applied. This, as Coeurdacier and Guibaud (2011) explain, is done to make sure that the trade is independent from a country's size. The variable is: $\text{Log}\left(\frac{EXP_{ijt}+IMP_{ijt}}{GDP_{it}*GDP_{jt}}\right)$.

4.2.12 Other Control Variables

Border variable is a dummy variable that is equal to one when pairs of source and destination countries share a common border. The currency variable is also a dummy variable. It is equal to one when two countries share a common currency such as Euro for the members of the European Union. The legal system variable represents the origin of the legal system for each country. Four legal systems are distinguished: English, French, German and Scandinavian. The language variable controls for countries with common language. Each regression also includes period fixed effects for years 2001 to 2008 and regional dummies (Europe, North America, Central and South America, Africa, Asia and Oceania).

4.3 Gravity Model

In the first part of the methodology, this paper attempts to replicate the results obtained by Coeurdacier and Guibaud (2011) using 2001 to 2005 sample. The ordinary least squares

method is utilized to run several regressions of bilateral equity holdings on the explanatory variables. Each sequential regression includes either more gravity variables or fixed effect specifications, or both. This stage is done to ensure the validity of the method as it pertains to a different data set.

The initial gravity model takes the following form[36]:

$$\text{Log}(\text{ Equity })_{ijt} = \beta_0 + \beta_1 \text{Log}(\text{ (Mkt Cap)}_{it} * (\text{Mkt Cap})_{jt}) + \beta_2 \text{corr}(\text{Log}(\frac{S_t}{S_{t-1}})_i, \text{Log}(\frac{S_t}{S_{t-1}})_j)_{t-9,t} +$$
$$\beta_3(\text{ Exp Ret })_{jt} + \beta_4 \text{Log}[(\frac{\text{GDP}}{\text{Capita}})_{it} * (\frac{\text{GDP}}{\text{Capita}})_{jt}] + \beta_5 \text{Log}(\text{ Dist })_{ij} + \beta_6(\text{ Border })_{ij} + \beta_7 \text{Log}(\frac{EXP_{ijt}+IMP_{ijt}}{GDP_{it}*GDP_{jt}}) + \quad (26)$$
$$\beta_8(\text{ Currency Union })_{ij} + \beta_9(\text{ Legal System })_{ij} + \beta_{10}(\text{ Language })_{ij} + \varepsilon_t$$

The model is estimated by OLS regressions applied to unbalanced panel data sets. The frequency of the data is annual from periods 2001-2005, and 2001-2008. There are two exceptions for the generated frequency: the stock market indices and the real exchange rates. These two sets are provided in a monthly frequency where the ten year rolling window technique (see Data Section) is applied to transform the data into the required annual frequency. Source and destination country dummies[37] are included to control for countries' size and wealth, as well as period fixed effects to control for period effects in a panel data setting. Subscript denoted by *i* refers to source countries, and *j* refers to destination countries. Bilateral equity holdings ($\text{Log}(\text{Equity})_{ijt}$) represent source country holdings in a given destination country within year *t*. Market capitalisation serves as a measure of countries' wealth. As I will later show, β_1 is very close to one in almost all estimations and it also explains most of the variation in bilateral equity holdings. The term $\text{corr}(\text{Log}(\frac{S_t}{S_{t-1}})_i, \text{Log}(\frac{S_t}{S_{t-1}})_j)_{t-9,t}$ represents 10-year rolling window correlations for pairs of source and destination countries.[38] Expected returns (ExpRet_{jt}) correspond to the anticipated returns to take place in the subsequent year in a destination country. The estimated coefficient is expected to have a positive sign because higher expected returns in a destination

[36] Results for this equation, as well as equations (27) and (28) are given in Appendix IV.
[37] Source and destination country dummies are included to control for country's size and wealth, simply, each source and destination country has a dummy variable that is equal to one when there are observations that relate to that country, and zero otherwise.
[38] S_t represents country's equity index at time t. It is the standard index covering all large and medium market capitalization securities of a country.

country in the following year should increase source countries' equity holdings in that country. The other variables utilized are common to most gravity models and are self-explanatory. GDP per capita ratio is used to measure the level of financial development of both source and destination countries. It is commonly accepted that more financially developed and wealthier countries are more likely to hold more equities in other countries. The distance variable, as given by the international trade theory, is expected to be inversely related to the bilateral equity holdings. As distance increases between two countries, a source country's foreign equity holdings are likely to drop. The dummy variable that controls for the common border between two countries is expected to enter with a positive sign. Positive relationship is also expected for currency union, legal system and language variable. The trade variable ($\text{Log}(\frac{EXP_{ijt}+IMP_{ijt}}{GDP_{it}*GDP_{jt}})$) represents trade relationships (exports plus import) between source and destination countries that are adjusted for the size of each country. Also, as mentioned before, if the countries are more open to trade they should have higher cross-border equity holdings, so the expected relationship is to be positive. The term denoted by ε_t represents the disturbance term. The above model is the main gravity model that creates the foundation for the methodology in this paper.

Upon completion of testing the initial gravity model, Coeurdacier and Guibaud (2011) realized that it suffers from misspecification given that the level of bilateral equity holdings and stock market returns for pairs of source and destination countries depend on the level of financial integration between those countries. The authors indicate that investigating the effect of stock market correlations on cross-border equity holdings, without accounting for the level of financial integration, results in biased OLS estimators. Economic theory implies that bilateral stock market correlations should be inversely related to bilateral equity holdings. Such a relationship would indicate that investors who desire to diversify their portfolio allocations look for foreign markets that exhibit low or negative stock market correlations with the home economy. Such allocations ensure that the overall portfolio risk is reduced without affecting the expected portfolio returns. However, in practice, the uncovered relationship between stock market correlations and equity holdings is positive. To remove that bias, Coeurdacier and Guibaud (2011) instrument[39] current

[39] IV-Estimation method for classical regression models is used when regressors provide information about the expectations of disturbances, that is, the disturbances and the regressors are correlated. The regressors are no longer exogenous. In such a case the OLS estimator is biased and inconsistent. To deal with this endogeneity it is important to find variables, "instruments," that satisfy the following properties: i) they are uncorrelated with the

stock market correlations with past stock market correlations, where past correlations are derived from a time period characterized by very low integration between financial markets.[40] This approach enables introducing an instrument that is correlated with the endogenous explanatory variable, but at the same time, it does not suffer from the same correlation problem as the original variable. Thus, the instrument removes the endogeneity bias by accounting for the financial integration between countries that positively affects bilateral equity holdings. By following Coeurdacier and Guibaud (2011) approach, the IV-estimation method is implemented, which represents the two-stage regression. The first-stage of the regression includes regressing stock market correlations on past correlations and other control variables. The instrumented correlations, the IV-correlations received in stage one, are then used to replace the current correlations in the initial gravity model.

From equation (27), the first-stage regression for the IV estimation, instrumented current stock market correlations with past correlations are obtained. Coeurdacier and Guibaud (2011) use past stock market correlations for years 1950 to 1975. In this paper the past correlations are for period 1970 to 1980. Financial integration among international markets took place after the 1980s (Agenor, 2003) and although both sets of data for the past stock market correlations (1950-75 and 1970-80) are from a time period before market capitalization escalated it is unlikely that these sets will work in the same way by capturing similar properties and provide comparable instruments.[41] The new correlations are time invariant:

$$\text{corr}\left(\text{Log}\left(\frac{S_t}{S_{t-1}}\right)_i, \text{Log}\left(\frac{S_t}{S_{t-1}}\right)_j\right)_{t-9,t} = \gamma_0 + \gamma_1 \text{corr}\left(\text{Log}\left(\frac{S_t}{S_{t-1}}\right)_i, \text{Log}\left(\frac{S_t}{S_{t-1}}\right)_j\right)_{1970\text{-}1980} + \gamma_2 \text{Log}(\text{Dist})_{ij} + \gamma_3(\text{Border})_{ij} + \gamma_4(\text{Legal System})_{ij} + \gamma_5(\text{Language})_{ij} + \varepsilon'_t \quad (27)$$

disturbance term; ii) they are correlated with the regressor(s). The instruments are then included in the estimation process, the two-stage least squares regression. The new IV-estimator, if estimated properly, will be consistent. Source: Greene, William H. Econometric Analysis. Upper Saddle River, New Jersey: Person Education, 2008

[40] For Coeurdacier and Guibaud (2011) that correlation is calculated based on sample 1950 to 1975. In this paper this correlations is for years 1970 to 1980 due to a constrained availability of the data.

[41] Years 1944-73 were characterized by fixed exchange rates under the Bretton-Woods system (Copeland, L., Exchange Rates and International Finance), were flexible exchange rates were allowed after the breakage of the system in 1973; also in that period of time countries had strict controls on capital movements, exports and imports. Also, important difference between the two periods comes from business cycles, where business cycles in 1950-70 were not as much synchronized as those after 1970 (Kose et al., 2003).

Next, the IV-correlations are calculated based on the estimated coefficients obtained in the first stage. In the second-stage, the current stock market correlations are replaced with the time invariant IV-correlations and the following model is estimated:

$$\text{Log}(\text{ Equity })_{ijt} = \phi_0 + \phi_1 \text{Log}(\text{ (Mkt Cap)}_{it} * \text{(Mkt Cap)}_{jt}) + \phi_2(\text{ IV-Correlations })_{ij} + \phi_3(\text{ Exp Ret })_{jt} + \phi_4 \text{Log}\left[\left(\frac{\text{GDP}}{\text{Capita}}\right)_{it} * \left(\frac{\text{GDP}}{\text{Capita}}\right)_{jt}\right] + \phi_5 \text{Log}(\text{ Dist })_{ij} + \phi_6(\text{ Border })_{ij} + \phi_7 \text{Log}\left(\frac{\text{EXP}_{ijt}+\text{IMP}_{ijt}}{\text{GDP}_{it}*\text{GDP}_{jt}}\right) + \phi_8(\text{ Currency Union })_{ij} + \phi_9(\text{ Legal System })_{ij} + \phi_{10}(\text{ Language })_{ij} + \varepsilon''_t \quad (28)$$

Using a different time period to create the instrumented variable provides results that differ from the ones reported by Coeurdacier and Guibaud (2011). Bilateral equity holdings increase with higher stock market correlations. Although both instruments represent a time period when stock markets were highly segmented, they do not behave in the same way. The most likely cause responsible for this behaviour is the fact that stock market correlations for years 1970 to 1980 are from a time period when stock markets were more developed than the ones captured by period 1950 to 1975. The different effect captured by the instrumented variable provides an important contribution to the methodology used by Coeurdacier and Guibaud (2011). The decision is to drop the two-stage estimations and focus on the main gravity model where the new variable is included and the sample size is expanded to include the years from 2001 to 2008. This model is also estimated several times by adding different variables and country specific effects. As I will later show, the following model appears to work well with the new explanatory variable.

The new model is:[42]

$$\text{Log}(\text{ Equity })_{ijt} = \theta_0 + \theta_1 \text{Log}(\text{ (Mkt Cap)}_{it} * \text{(Mkt Cap)}_{jt}) + \theta_2 \text{corr}\left(\text{Log}\left(\frac{S_t}{S_{t-1}}\right)_i, \text{Log}\left(\frac{S_t}{S_{t-1}}\right)_j\right)_{t-9,t} + \theta_3 \text{corr}(\widehat{\text{RER}}, \widehat{\text{Re}})_{ijt} + \theta_4(\text{ Exp Ret })_{jt} + \theta_5 \text{Log}\left[\left(\frac{\text{GDP}}{\text{Capita}}\right)_{it} * \left(\frac{\text{GDP}}{\text{Capita}}\right)_{jt}\right] + \theta_6 \text{Log}(\text{ Dist })_{ij} + \theta_7(\text{ Border })_{ij} + \theta_8 \text{Log}\left(\frac{\text{EXP}_{ijt}+\text{IMP}_{ijt}}{\text{GDP}_{it}*\text{GDP}_{jt}}\right) + \theta_9(\text{ Currency Union })_{ij} + \theta_{10}(\text{ Legal System })_{ij} + \theta_{11}(\text{ Language })_{ij} + \varepsilon_t \quad (29)$$

[42] Results for this equation are provided in Appendix V.

It is important to note that in the above model the estimated coefficients on stock market correlations may suffer from the same positive bias. Since the two-stage estimation method is excluded from the methodology, the positive correlation between cross-border equity holdings and stock market correlations may still be present. However, as I will later demonstrate, introducing the new variable accompanied by the double fixed effect specification[43] has a similar effect on the stock market correlations as the initially used instrumented correlations.

5. RESULTS

5.1 Descriptive Statistics

The studies presented in this paper utilize data sources that differ for most variables from those used by Coeurdacier and Guibaud in "International Portfolio Diversification is better than You Think" (2011), therefore the descriptive statistics and the estimated coefficients are of different magnitudes. The dependent variable, bilateral equity holdings, is retrieved from the same source called the Portfolio Investment: CPIS Data provided by the International Monetary Fund,[44] however, it was accessed on a different date. The IMF IFS website[45] warns that the statistical data is subject to annual updates, therefore, the data used by Coeurdacier and Guibaud (2011) most likely differs from the one used in this paper. This inconsistency in the dependent variable may affect the estimated coefficients and the fit of a given model. By investigating the descriptive statistics for the sample 2001 to 2005[46] the mean, standard deviation, and the maximum values calculated for the bilateral equity holdings are higher on average but still close to those from "International Portfolio Diversification is Better than You Think" (2011). The minimum values are lower, or more negative.

Distance is calculated between the two largest cities. The descriptive statistics for this paper and Coeurdacier and Guibaud (2011) is very comparable, however not exact. To estimate geographical proximity Coeurdacier and Guibaud (2011) used the distance between the two main

[43] The double fixed effect refers to controlling for source and destination countries' fixed specifications.
[44] The exact directory for the data is provided in the section "Data Sources."
[45] Information provided by International Monetary Fund website. Retrieved from: http://www.imf.org/external/np/sta/pi/datarsl.htm.
[46] Please see Appendix IV – Replicated Results.

cities of each source and destination country. This could refer to either capital cities, most populated or most spread out cities. The website providing software for calculating the distance used by Coeurdacier and Guibaud (2011) was also utilized in this paper.[47]

The mean and standard deviation for the sum of exports and imports are close but also higher on average than the data reported in the original paper. Hong Kong is the only exception where the mean is twice as high. Coeurdacier and Guibaud (2011) used bilateral exports and imports provided by the CHELEM dataset.[48] For the use in this paper the data comes from IMF's Direction of Trade Statistics.[49] It is important to remember that different organizations include different factors when measuring a particular variable. It is possible that what is defined as total exports or imports by the CHELEM database may not be the same, as what is measured by IMF DOTS. Consequently, there are discrepancies in the descriptive statistics for this variable.

Stock market correlations calculated as ten year rolling window correlations also show some differences in the estimated statistics. Here, not only the mean, standard deviation and the maximum values are higher on average, but also the minimum values are less negative. Higher mean implies higher degree of financial integration captured by the data. Higher standard deviation implies more volatility in the observations. Coeurdacier and Guibaud (2011) use monthly end-of-period national stock indices provided by the Global Financial Data which is available for years 1950 to present. For this paper, end-of-month data from MSCI Barra is used which is based on standard large and medium cap indices which are available as of December 31, 1969. In addition, it is not clear on how Coeurdacier and Guibaud (2011) calculated the stock market returns using stock market indices. There are several ways in which this calculation could be accomplished. Moreover, even more discrepancies come from calculating past stock market correlations. Coeurdacier and Guibaud (2011) calculate those correlations from sample 1950 to 1975. The authors get the benefit of using past correlations which are characterized by lower means and lower standard deviations. The correlations used by the authors are from a time period when the national stock markets were all highly segmented. The authors use the past correlations for the instrumented variable in order to adjust for the high level of financial integration that affects both, the stock market correlations and bilateral equity holdings. In my methodology,

[47] The directory for the retrieved data is provided in the section "Data Sources"
[48] Centre d'Etudes Propectives et d'Informations Internationales, CEPII, Paris.
[49] DOTs, Provided by ©2010 Euromonitor International and IMF.

however, I was limited by a subset of 18 countries for which the earliest stock market returns are for years 1970 to 1980. This constraint produced descriptive statistics for the past correlation that is not only higher on average in the mean and standard deviation, but also very close, or even in some cases greater in magnitude than the estimated measures for the current ten year rolling window correlations. This implies that the national stock markets were characterized by higher correlations after the 1970s, and that they may not have similar properties as stock market returns from 1950 to 1975. The set of past correlations used in this paper, as I will demonstrate in the next section, will not be a good instrument to remove the endogeneity bias. While acknowledging the endogeneity problem in the later stages of the paper, due to the lack of data necessary to create a good instrument, the instrumented variable is not implemented in the final gravity model.

5.2 Gravity Model for Equity Holdings: OLS Estimation

Table 2 includes the estimated coefficients for the first gravity model (equation (26)) compared with the results obtained by Coeurdacier and Guibaud in "International Portfolio Diversification is better than You Think" (2011).

In the first regression, the logarithm of bilateral equity is regressed only on the logarithm of the product of countries' market capitalisation and stock market correlations. The estimates on the market capitalization are close to one, which suggests that a 1% increase in the product of countries' market capitalisation will increase the bilateral equity holdings by about 1%. It is also believed that market capitalisation explains most of the variation in the bilateral equity holdings, that is, about 50% of the variation in the depended variable. For Coeurdacier and Guibaud (2011) this coefficient implies that a 0.01 unit increase in the stock market correlations will increase the bilateral equity holdings by 3.88%. My regression suggests that the bilateral equity holdings would increase by 6.29%, which is both economically and statistically significant. The positive relationship indicates that the higher the integration of the world's stock markets, the higher are the equity holdings in the destination country. This does not support the belief that investors properly diversify their portfolios to reduce the risk associated with investment by redirecting some of their investments to countries that exhibit low stock market correlation with the home economy.

The second regression includes additional gravity variables. The coefficients enter with similar signs for both models. The difference lies in the statistical significance. With the exception of the border variable, the estimates are significant at the 1% significance level. The coefficients from the Coeurdacier and Guibaud (2011) lack such strong significance. The coefficient for market capitalisation is close to one. The coefficient on stock market returns is again positive. The positive coefficient for the expected returns suggests that a 0.01 increase in the expected returns in the destination country during the next year will drive the source country to increase the cross-border equity holdings by 0.67%. The coefficient on GDP per capita ratio also enters with a positive sign. Wealthier countries, as expressed in GDP measures, are more likely to hold more foreign equities. Thus, with an increase in a country's per person wealth, foreign equity holdings are expected to rise as well. The distance variable suggests that with greater distance between two countries, cross-border equity holding are expected to decrease. The border variable enters with a negative sign in both cases, however, it is not statistically significant. Finally, the higher the volume of exports and imports moved between two countries, the higher the level of equity held in the destination country. This also supports a common belief that countries which embrace trade should hold more equities abroad.

Additional gravity variables are introduced to the next four regressions where I control for either source or destination country fixed specifications or both. In the third regression, my estimates are again similar to those obtained by Coeurdacier and Guibaud (2011), but slightly higher on average. Common currency between countries may ease business transactions and increase the willingness to buy equities abroad. However, it may also imply higher level of financial integration between the two countries, and therefore, higher stock market correlations. For Coeurdacier and Guibaud (2011) this coefficient is negative and statistically significant implying that investors prefer to invest in foreign markets that do not share the same currency with the domestic economy. Moreover, home investors may prefer to invest in countries where they can benefit from exchange rate returns. Similarly, legal system shared by the source and the destination country could facilitate the willingness to invest abroad, however, this also results in less disparity between the two markets. The same observation is true for the common language variable which appears to play a significant role in explaining the variability in the cross-border equity holdings. The estimated coefficient is positive, implying that investors feel more comfortable to invest in countries that share the same language with the home country.

Table 2: Gravity Model for Equity Holdings – OLS Estimation. Results compared with those obtained by C&G (2011).

	Log($Equity_{ijt}$)											
	(1)	C&G (1)	**(2)**	C&G (2)	**(3)**	C&G (3)	**(4)**	C&G (4)	**(5)**	C&G (5)	**(6)**	C&G (6)
Log($MktCap_{it}$*$MktCap_{jt}$)	**1.089*** (.021)**	.754*** (.151)	**1.043*** (.020)**	.865*** (.108)	**1.042*** (.020)**	.820*** (.100)	**1.217*** (.024)**	.898*** (.051)	**.971*** (.021)**	.757*** (.028)		
$Correlation_{ijt}$	**6.288*** (.271)**	3.880*** (.996)	**2.046*** (.276)**	1.017 (.822)	**1.784*** (.280)**	1.007 (.779)	**2.014*** (.252)**	.510* (.306)	**1.659*** (.276)**	1.761*** (.234)	**.248 (.316)**	1.063*** (.245)
$ExpRet_{jt}$			**.667*** (.216)**	.421* (.252)	**.658*** (.216)**	.436* (.245)	**.274 (.171)**	-.202 (.210)	**.081 (.189)**	1.423*** (.194)	**-.292* (.168)**	.681*** (.183)
Log[$(Gdp/Cap)_{it}$ *$(Gdp/Cap)_{jt}$]			**.842*** (.037)**	.758*** (.182)	**.839*** (.037)**	.787*** (.181)	**.005 (.038)**	.036 (.076)	**2.280*** (.048)**	2.136*** (.064)	**.482** (.218)**	.494* (.288)
Log($Distance)_{ij}$			**-.724*** (.050)**	-.952*** (.288)	**-.771*** (.052)**	-1.079*** (.283)	**-.187*** (.054)**	-1.228*** (.103)	**-.303*** (.050)**	-.073 (.064)	**-.341*** (.062)**	-412*** (.083)
$Border_{ij}$			**-.256 (.162)**	-.313 (.420)	**-.499*** (.167)**	-.764* (.418)	**-.131 (.132)**	-.545** (.219)	**-.279** (.140)**	-.385** (.164)	**-.124 (.123)**	-.274 (.175)
Log[$(Exp_{ijt}$+$Imp_{ijt})$ /$(Gdp_{it}$*$Gdp_{jt})$]			**.271*** (.036)**	.205 (.238)	**.230*** (.037)**	.131 (.242)	**.524*** (.039)**	-.018 (.072)	**.464*** (.034)**	.620*** (.051)	**.553*** (.045)**	.427*** (.066)
$Currency_{ijt}$					**.083 (.123)**	-.435** (.217)	**.173 (.107)**	-.148 (.163)	**.122 (.112)**	.062 (.133)	**.512*** (.112)**	.196 (.147)
$LegalSystem_{ij}$					**.135 (.085)**	.113 (.243)	**.329*** (.069)**	.267*** (.103)	**.250*** (.071)**	.161* (.083)	**.387*** (.064)**	.259*** (.081)
$Language_{ij}$					**.550*** (.133)**	.633** (.285)	**.222** (.108)**	.371*** (.121)	**.712*** (.114)**	.680*** (.091)	**.014 (.103)**	.411*** (.107)
Source Country Dummies	**No**	No	**No**	No	**No**	No	**Yes**	Yes	**No**	No	**Yes**	Yes
Destination Country Dummies	**No**	No	**No**	No	**No**	No	**No**	No	**Yes**	Yes	**Yes**	Yes
Number of Observations	**4166**	4731	**4160**	4388	**4160**	4388	**4160**	4388	**4160**	4388	**4160**	4388
R^2	**.582**	.379	**.673**	.514	**.675**	.519	**.806**	.473	**.788**	.524	**.845**	.590

All regressions include regional and period fixed effects:
(4) with source country dummies; (5) with destination country dummies; (6) with source and destination country dummies.
Standard errors are in parenthesis. Statistical significance at 1%, 5% and 10% is denoted by ***, **, and *.

In the fourth regression I add source country dummies. The coefficient for stock market correlations is again economically and statistically significant at the 1% significance level, while the one estimated by Coeurdacier and Guibaud (2011) is statistically significant only at 10%. Controlling for source country fixed effects in Coeurdacier and Guibaud (2011) switches the sign for the expected returns and the trade variable. These explanatory variables are inversely related to cross-border equity holdings, however, they are not statistically significant. Also, countries' wealth seems to be insignificant when controlling for the source country effects.

In the fifth regression, controlling for the destination country effects indicates that the expected returns are very important in the determination of cross-border equity holdings. Coeurdacier and Guibaud (2011) conclude that a 0.01 increase in the expected returns in the destination country in the next year would drive home investors to increase foreign equity holdings in that country by 1.42%. In my model controlling for destination country effects does not have the same impact on the expected returns. This coefficient is positive, but not statistically or economically significant.

The last regression includes the double fixed effect specification which consists of both, source and destination country dummies. When controlling for source and destination country, the market capitalisation is excluded from the estimation to avoid linear dependence. The estimate for the stock market correlations is not economically or statistically significant, but it is significant for Coeurdacier and Guibaud (2011). Moreover, it does not enter with the expected sign for either model. The model suggests that stock market correlations seem to be irrelevant while trying to determine the level of cross-border investment. Also, when I control for source and destination country fixed effects, the sign of the expected return is reversed. The negative relationship between the expected returns and bilateral equity holdings implies that if the stock market returns were expected to decrease in the following year in the destination country, then the cross-border equity holdings would increase in that country, which does not support the economic theory.

Overall, both models seem to provide a good fit for modeling the variability in the dependent variable. However, neither my model nor the one estimated by Coeurdacier and Guibaud (2011) suggests that investors tilt their bilateral equity holdings in the right direction

when considering the diversification motive. Coeurdacier and Guibaud (2011) argue that the results obtained in Table 2 are misspecified because they suffer from a positive endogeneity bias. To remove that bias it is necessary to take into account the level of financial integration in today's world. Coeurdacier and Guibaud (2011) do so by instrumenting current correlations with past correlations. The instrumented correlations, then, replace the ten year rolling window correlations in the same model.

5.3 First Stage Regression

In this stage I try to replicate the result Coeurdacier and Guibaud (2011) obtained in the first stage of the IV estimation. Coeurdacier and Guibaud (2011) estimate a regression of ten year rolling window correlations on past correlations 1950 to 1975 and a set of other explanatory variables. In this model, past correlations are calculated for years 1970 to 1980. The estimated coefficients are very similar for both models.

Equation (27) takes the following values for Coeurdacier and Guibaud (2011):

$$\text{corr}\left(\text{Log}\left(\frac{S_t}{S_{t-1}}\right)_i, \text{Log}\left(\frac{S_t}{S_{t-1}}\right)_j\right)_{t-9,t} = \gamma_0 + .160^{***}\ \text{corr}\left(\text{Log}\left(\frac{S_t}{S_{t-1}}\right)_i, \text{Log}\left(\frac{S_t}{S_{t-1}}\right)_j\right)_{1950\text{-}1975} - .065^{***}\text{Log}(\text{Dist})_{ij} -$$

$$-.042^{***}(\text{Border})_{ij} - .018^{***}(\text{Legal System})_{ij} + .076^{***}(\text{Language})_{ij} + \varepsilon'_t$$

My model:

$$\text{corr}\left(\text{Log}\left(\frac{S_t}{S_{t-1}}\right)_i, \text{Log}\left(\frac{S_t}{S_{t-1}}\right)_j\right)_{t-9,t} = \gamma_0 + .140^{***}\ \text{corr}\left(\text{Log}\left(\frac{S_t}{S_{t-1}}\right)_i, \text{Log}\left(\frac{S_t}{S_{t-1}}\right)_j\right)_{1970\text{-}1980} +$$

$$-.059^{***}\text{Log}(\text{Dist})_{ij} - .046^{***}(\text{Border})_{ij} + .054^{***}(\text{Legal System})_{ij} + .015(\text{Language})_{ij} + \varepsilon'_t$$

Coeurdacier and Guibaud (2011) results imply that 0.01 unit increase in past stock market correlations will increase the ten year rolling window correlations by 0.0016 units. My model implies that the increase would be equal to 0.0014 units. It is important to keep in mind that in this estimation, the first stage regression includes the data for 17 source and 18 destination countries supplying only 1524 (compared to 4725 observations for Coeurdacier and Guibaud (2011)). Also, stock market returns for years 1970 to 1980 are characterized by higher on

average correlations than those calculated for time period 1950 to 1975. This difference will have a significant impact on replicating the results using the equation (28).

5.4 Gravity Model for Equity Holdings using Instrumented Stock Return Correlations

The instrumented variable attempts to capture the true effect that stock market correlations have on bilateral equity holdings. By instrumenting current stock market correlations with past correlations, Coeurdacier and Guibaud (2011) account for the level of financial integration that determines both: stock market correlations and bilateral equity holdings. By removing this endogeneity bias, the instrumented correlations should now be inversely related to cross-border equity holdings. Particularly, it should be evident that investors invest in countries that have stock markets that are not positively correlated with the domestic market. Such result would be in favour of the proposition that investors hold properly diversified portfolios.

Table 3 (equation 28) demonstrates that Coeurdacier and Guibaud (2011) are able to uncover this relationship. Their results indicate that a 0.01 increase in the stock market correlations would decrease the foreign equity holdings by 4.53 to 6.91%. However, my model does not yield the same results. The results obtained in this paper for equation (28) imply that an increase in stock market correlations would increase bilateral equity holdings by 0.99 to 3.51%. Thus, although my model seems to work well without the instrumented variable, the past correlations based on 1970 to 1980 period do not provide the same effect as the correlations calculated for 1950 to 1975. Coeurdacier and Guibaud (2011) were able to receive the expected sign for the coefficient by removing the endogeneity bias. Coeurdacier and Guibaud (2011) model suggests that investors properly hedge the exposure associated with the domestic investment by shifting some of their investments to other countries that exhibit low stock market correlations with the domestic market. In this paper, however, the model supports the conclusion obtained in the Table 2 which states that investors do not diversify their portfolio properly.

Table 3: Second Stage Regression: Gravity Model for Equity Holdings with Instrumented Correlations, OLS Estimation. Results compared to C&G (2011).

	$Log(Equity_{ijt})$							
	(1)	C&G (1)	**(2)**	C&G (2)	**(3)**	C&G (3)	(4)	C&G (4)
$Log(MktCap_{it}*MktCap_{jt})$	**.972*** (.020)**	.932*** (.093)	**1.303*** (.025)**	1.176*** (.055)	**.844*** (.022)**	.793*** (.029)		
$IV\text{-}Correlation_{ijt}$	**.987 (2.019)**	-6.910 (4.726)	**2.114 (1.801)**	-5.760*** (2.108)	**3.511* (2.122)**	-6.667*** (2.019)	**3.512 (2.206)**	-4.526* (2.375)
$ExpRet_{jt}$	**-1.592*** (.323)**	.023 (.248)	**.779*** (.286)**	-.019 (.259)	**-.784** (.342)**	1.703*** (.227)	**-.668** (.275)**	.819*** (.217)
$Log[(Gdp/Cap)_{it}*(Gdp/Cap)_{jt}]$	**1.557*** (.104)**	1.103*** (.194)	**.604*** (.102)**	-.001 (.097)	**2.151*** (.120)**	2.163*** (.067)	**.323 (.249)**	.300 (.319)
$Log(Distance)_{ij}$	**-.395*** (.131)**	-1.079*** (.324)	**.017 (.125)**	-1.165*** (.152)	**-.214 (.136)**	-479*** (.117)	**.145 (.153)**	.-699*** (.153)
$Border_{ij}$	**-.050 (.153)**	-.704* (.378)	**.093 (.129)**	-.568** (.242)	**.150 (.153)**	-.642*** (.198)	**.152 (.144)**	-.480** (.204)
$Log[(Exp_{ijt}+Imp_{ijt})/(Gdp_{it}*Gdp_{jt})]$	**.026 (.037)**	.368* (.213)	**.394*** (.039)**	.208*** (.073)	**.006 (.037)**	.650*** (.057)	**.478*** (.049)**	.397*** (.071)
$Currency_{ijt}$	**.870*** (.106)**	.274 (.350)	**.525*** (.093)**	.324 (.199)	**.682*** (.102)**	.487*** (.161)	**.468*** (.097)**	.649*** (.198)
$Legal\ System_{ij}$	**.487*** (.127)**	.0002 (.236)	**.350*** (.112)**	.147 (.110)	**.353** (.131)**	.099 (.098)	**.234* (.135)**	.268*** (.094)
$Language_{ij}$	**.243* (.127)**	1.003** (.509)	**.025 (.105)**	.723*** (.188)	**.173 (.124)**	1.254*** (.199)	**-.073 (.110)**	.788*** (.218)
Source Country Dummies	**No**	No	**Yes**	Yes	**No**	No	**Yes**	Yes
Destination Country Dummies	**No**	No	**No**	No	**Yes**	Yes	**Yes**	Yes
Number of Observations	**1487**	3915	**1487**	3915	**1487**	3915	**1487**	3915
R^2	**.789**	.516	**.875**	.454	**.831**	.518	**.892**	.591

All regressions include regional and period fixed effects:
(2) with source country dummies; (3) with destination country dummies; (4) with source and destination country dummies.
Standard errors are in parenthesis. Statistical significance at 1%, 5% and 10% is denoted by ***, **, and *.

As shown by the estimates, regression (1) to (4) in Table 3, the results obtained for the purpose of this paper differ from those obtained by Coeurdacier and Guibaud (2011). Therefore, due to the different properties that are delivered by the instrumented variables for periods 1950-75 and 1970-80, the decision is to not proceed with the same approach. The gravity model which could be found in equation (29) is incorporated, instead, as the final model.

5.5 OLS Estimation with $\mathbf{corr}(\widehat{\mathbf{RER}}, \widehat{\mathbf{Re}})$

Table 4 represents the earlier described gravity model for bilateral equity holdings. In this instance the gravity model includes time period 2001 to 2008 and a new variable described as the correlation between real exchange rate fluctuations and relative excess returns. The results consist of seven OLS estimations. All of the regressions include country and period fixed effects, regressions (5), (6) and (7) respectively include source country dummies, destination country dummies and both. Again, the coefficient for the product of countries market capitalisation is close to one for all estimations and it is significant at all levels. This is consistent with the previous estimations based on period sample 2001 to 2005. The results indicate that 1% increase in market capitalisation can increase bilateral equity holdings by 1.06 to 1.34%. Stock market correlations enter with a positive sign for all regressions with the exception of the last regression where I use the double fixed effect specification. For regressions (1) to (6) the model suggests that 0.01 unit increase in stock market correlations between a source and a destination country can increase the cross-border equity holding by 1.35 to 6.20% which is also significant at the 1% significance level. When I control for source and destination country effects, in regression (7), my results imply that the bilateral equity holding would decrease by 0.34%, however this coefficient is not statistically significant. The computation of the ten year rolling window correlations for the rate of change in the real exchange rates and the relative excess returns delivered correlations out of which 91% are negative, and only 9% are positive. Also, only 4.72% of the positive correlation is higher than 0.20 (which is equal to 0.47% of all correlations), whereas 18.56% of all negative correlations are less than -0.50 (which is equal to 16.88% of all observations). The estimated coefficient for this variable enters with both positive and negative signs and it is significant for all regressions. The sign of the coefficient depends on the number of explanatory variables and fixed effect specification included. For the first two regressions, the

coefficient is positive. In this case the results imply that a 0.01 unit increase in the correlation can increase bilateral equity holdings by 0.66 to 1.59%. This is both, statistically and economically significant (the statistical significance is at 1%). For regressions (3) to (6), the coefficient is negative. Regressions (3) and (4) include more explanatory variables, whereas regression (5) and (6) include respectively source and destination country dummies. Here, an increase of 0.01 unit in correlation decreases the cross-border equity holdings by 0.25 to 1.64%. When the double fixed effect specification is included, that is, when I control for source and destination countries' size and wealth, the coefficient changes the sign to positive and it suggests that 0.01 unit increase in the correlations between the fluctuations in real exchange rates and relative excess returns increase the cross-border equity holdings by 0.36%. This estimate is significant only at the 10% significance level with a p-value equal to 0.056. Also, an interesting observation relates to the expected returns variable. Here, most of the estimates for this variable enter with a negative sign, as opposed to the replicated result for time period 2001 to 2005 where most of the coefficients were positive, as predicted by Coeurdacier and Guibaud (2011). The estimated coefficient, using the double fixed effect specification, is both statistically (at 1%) and economically significant, and it implies that 0.01 unit increase in the expected returns in the destination country could decrease source country's equity holdings by 0.45%. This does not support the assumption that higher expected returns on foreign equity attract investors. The coefficient on the GDP per capita ratio is positive and significant for most regressions. When it is negative, it is insignificant. An increase of 1% in the product of per person wealth in either source or destination country could increase the bilateral equity holdings from 0.73% to 2.06%. Greater distance between two countries and a shared common border are likely to reduce equity holdings abroad. The trade variable, currency union, legal system and language are all directly related to cross-border equity holdings with a strong significance for all of them with the exception of the language variable. An increase in exports and imports could increase the foreign equity holdings by 0.24 to 0.61%.

Table 4: Gravity Model for Equity Holdings: OLS Estimation with $\text{corr}(\widehat{RER}, \widehat{Re})$

	Log($Equity_{ijt}$)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Log(MktCap_{it} * MktCap_{jt})$	1.339*** (.018)	1.155*** (.019)	1.100*** (.019)	1.092*** (.019)	1.242*** (.023)	1.056*** (.019)	
$Correlation_{ijt}$		6.196*** (.233)	1.927*** (.241)	1.829*** (.241)	1.346*** (.225)	2.007*** (.245)	-.342 (.278)
$\text{corr}(\widehat{RER}, \widehat{Re})_{ijt}$	1.591*** (.174)	.664*** (.168)	-1.101*** (.157)	-1.520*** (.171)	-.254* (.151)	-1.642*** (.184)	.364* (.191)
$ExpRet_{jt}$			-.092 (.160)	-.089 (.160)	-.401*** (.130)	.147 (.144)	-.449*** (.126)
$Log[(Gdp/Cap)_{it} * (Gdp/Cap)_{jt}]$			.726*** (.033)	.763*** (.034)	-.035 (.036)	2.060*** (.044)	1.480*** (.171)
$Log(Distance)_{ij}$			-.875*** (.045)	-.847*** (.045)	-.268*** (.047)	-.394*** (.046)	-.396*** (.056)
$Border_{ij}$			-.134 (.131)	-.277** (.138)	-.023 (.114)	-.150 (.121)	-.146 (.109)
$Log[(Exp_{ijt}+Imp_{ijt}) /(Gdp_{it}*Gdp_{jt})]$			.250*** (.029)	.243*** (.030)	.545*** (.034)	.507*** (.028)	.609*** (.039)
$Currency_{ijt}$				.569*** (.102)	.624*** (.090)	.469*** (.099)	.806*** (.098)
$Legal\ System_{ij}$				.140** (.069)	.258*** (.059)	.219*** (.060)	.271*** (.056)
$Language_{ij}$				.131 (.122)	.085 (.101)	.250** (.107)	-.025 (.097)
Source Country Dummies	No	No	No	No	Yes	No	Yes
Destination Country Dummies	No	No	No	No	No	Yes	Yes
Number of Observations	5687	5687	5684	5684	5684	5684	5684
R^2	.565	.613	.696	.699	.805	.784	.837

All regressions include regional and period fixed effects:
(5) with source country dummies; (6) with destination country dummies; (7) with source and destination country dummies.
Standard errors are in parenthesis. Statistical significance at 1%, 5% and 10% is denoted by ***, **, and *.

5.6 Discussion

The OLS estimation with the new variable, $\text{corr}(\widehat{RER}, \widehat{Re})$, provides a good fit for explaining the variability in bilateral equity holdings. Most of the estimated coefficients for the natural control variables are consistent with the *a priori* expectations. The exception is the coefficient for the expected stock market returns. The sign for this estimate is negative when the sample size is expanded from time period 2001 to 2005, up to 2008. As indicated before, I was not able to capture the expected effect of the stock market correlations on the bilateral equity holdings. This coefficient is positive and has a strong tendency for statistical and economical significance. It implies that the higher the stock market correlations between two countries, the higher are the cross-border equity holdings. A question is whether the sign of the stock market correlation variable would be negative, as it was for Coeurdacier and Guibaud (2011), when handling the 1950-75 stock market returns to create the instrumented variable. The sign for this coefficient does reverse itself under the double fixed effect specification, however, the estimated coefficient is not statistically or economically significant.

Negative correlations are indicative of investors making domestic investment, thus, investors experience home bias. When the correlations are positive, to better hedge against the real exchange rate fluctuations, investors should diversify internationally. Thus, positive correlations indicate foreign bias in equity allocations. The majority of calculated correlations[50] between real exchange rate fluctuations and relative excess returns are negative. In addition, many of the correlations exhibit very strong negative relationship. Positive correlations are few, and when they do take place, they are fairly weak. Therefore, when there are limited diversification opportunities, fewer investors will look into foreign markets to buy foreign equities. Furthermore, with respect to the coefficients reported in the final gravity model (regressions (1) to (7) in Table 4) , the estimated coefficients for the correlations between the changes in real exchange rates and the relative stock market returns provide slightly misleading results. The relationship captured is questionable because it could be either direct or inverse. The question is which of the models is accurate. When controlling for either source or destination country fixed effects, the relationship is negative since the coefficients enter with a negative sign.

[50] This refers to the actual correlations that were calculated for each pair of source and destination countries in a specific year using the ten year rolling window method, and not the coefficients obtained in the gravity model.

Whereas, when the double fixed effects are included the relationship is positive. Controlling for source and destination country fixed effects helps to control for countries' size and wealth. This is very important when determining the allocation of bilateral equity holdings since wealthier countries are more likely to hold more equities abroad. Consequently, the double fixed specification provides more reliable results. Therefore, in the case where the relationship between the bilateral equity holdings and the correlation between real exchange rate fluctuations and relative excess returns is positive, an increase in the correlation's magnitude would increase the foreign equity holdings. Thus, if the given correlation was negative, the model suggests that bilateral equity holdings would in fact fall. On the other hand, if the correlation was positive, then, foreign equity holdings would go up. This supports the proposition that investors, when considering various diversification opportunities, do use equities to hedge for real exchange rate fluctuations.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Recommendations

A question could be posed whether using the instrumented correlations and the two-stage regression, in order to provide the correct sign by removing the endogeneity bias, would have any effect on the sign of the new variable defined as the correlation between real exchange rate fluctuations and relative excess returns. If the instrumented stock market correlations reversed the effect of stock market correlations on bilateral equity holdings to the expected form, would I receive a positive relationship between stock market correlations and bilateral equity under the double fixed effect specification?

Another issue relates to the real exchange rate regime that is used in each country. This paper investigates 41 countries, including a number of European countries with study period starting in 2001. Countries, at the time of joining the European Union, converted their national currencies to Euro causing the rate to be fixed among those countries. Thus, the methodology applied in this paper investigates simultaneously both fixed and flexible exchange rates. To further examine whether equities are used to hedge real exchange rate risk a study excluding the European Union countries from the countries under the investigation should be conducted.

Consequently, one could measure whether the results obtained in this paper would hold for fixed and flexible exchange rate regimes separately.

Moreover, van Wincoop and Warnock (2009) find in their empirical paper that when real exchange rates are conditioned on the nominal exchange rates then the data is even less volatile. Real exchange rates, conditional on nominal, seem to be uncorrelated with the relative returns and have little effect in explaining the home bias in equity. Theory indicates that real and nominal exchange rates are closely related since real exchange rates are the nominal rates adjusted for inflationary differentials among the countries. Thus, real exchange rate fluctuations are mostly due to inflationary changes between the countries and they determine countries' relative competitiveness. A new investigation that remains to be explored is to study the dependence when $\text{corr}(\widehat{RER}, \widehat{Re})$ are conditional on the nominal exchange rates, or on the fluctuations in the nominal exchange rates. In addition, when the real exchange rate is conditional on the nominal exchange rate, one could measure whether it would be possible to use the correlation between real exchange rate fluctuations and relative excess returns to determine whether equities are used to hedge for real exchange rate risk?

6.2 Conclusions

In this paper I examine whether equities are used to hedge real exchange rate fluctuations by looking at 27 source and 41 destination countries. I employ Coeurdacier and Guibaud's (2011) gravity model which is estimated by OLS regressions. A novel feature is the incorporation of a new explanatory variable to the model which represents the correlations between real exchange rate fluctuations and relative excess returns. The purpose of the new variable is to examine whether it can help to explain the allocation of cross-border equity holdings and provide evidence that investors use equities to hedge for real exchange fluctuations. If negative correlations imply home bias and positive correlations foreign bias, then, given the particular market characteristics, I measure whether investors hold equities to properly hedge the fluctuations in real exchange returns. What I find is that the obtained results vary with respect to the specifications included within each regression. More specifically, it makes a difference

whether I control for either source or destination country fixed effects, or both.[51] In the first case, when controlling for either source or destination countries' size and wealth, the uncovered relationship of the correlation variable on the bilateral equity holdings is negative, which does not support my hypothesis. When the double fixed effect specifications are included in the model,[52] a raise in the correlations increases the cross-border equity holdings. Thus, when the correlations are negative, suggesting that to better hedge the real exchange fluctuations is to hold domestic equities, then the cross-border equity holdings will decrease. Whereas, when the correlations are positive, implying that it is less risky to invest in foreign equities, bilateral equity holdings will increase. Therefore, the model presented in this study does provide evidence that investors hedge real exchange rate fluctuations with equities to smooth consumption, however, since the results vary with respect to the specifications included more empirical testing should be conducted.

[51] Refer to Table 4, and the estimated coefficients for the correlations between the real exchange rate fluctuations and the excess returns.
[52] Table 4, regression (7).

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2. Market Capitalisation: Provided by The World Bank, Working for a World Free of Poverty: http://data.worldbank.org/indicator/CM.MKT.LCAP.CD. The same data can also be found ©2010 Euromonitor International (GMID - Global Market Information Database, access provided by University of Saskatchewan). It is explained that the data is in current US dollars, in year-on-year exchange rates. Sources for the data include the following providers: Standard and Poor's, Emerging Stock Market, and supplemental S&P data.

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APPENDIX I: MATHEMATICAL FRAMEWORK BEHIND THE MODEL

Endowment economy with two periods t=0,1, and two symmetric countries, Home (H) and Foreign (F). Each country has a representative household that produces one differentiated good. Countries trade and consume both goods with a preference for the domestically produced good. In period t=0 consumers trade only stocks (no consumption, no output). In period t=1 country *i* receives stochastic endowment y_i: $E(y_H)=E(y_F)=1$.[53]

Both countries share the same CRRA utility function (Constant Relative Risk Aversion):

$$U_i = E\left[\frac{C_i^{1-\sigma}}{1-\sigma}\right], \qquad (1)$$

where U represents utility, C is the aggregate consumption and $\sigma>1$ is constant and represents the coefficient of relative risk aversion. The aggregate consumption index is given by CES (Constant Elasticity of Substitution):

$$C_i = [a^{1/\varphi} c_{ii}^{(\varphi-1)/\varphi} + (1-a)^{1/\varphi} c_{ij}^{(\varphi-1)/\varphi}]^{\varphi/(\varphi-1)}, \qquad (2)$$

with $i \neq j$ and c_{ij} as the consumption of good j by country i, φ is the elasticity of substitution between good i and j, and a represents the share of consumption spending devoted to the domestically produced good ($1 \geq a \geq 1/2$) with home bias in preferences for $a \geq 1/2$ (and $a=1/2$ represents identical preferences for both, home and foreign goods).

The corresponding price index is:

$$P_i = [a p_i^{1-\varphi} + (1-a) p_j^{1-\varphi}]^{1/(1-\varphi)} \qquad (3)$$

Where i, j = F, H, and $i \neq j$.

At time t=1, when a shock is realised, household i maximizes utility U_i given the following budget constraint where I represents income: $P_i C_i = p_i c_{ii} + p_j c_{ij} \leq I$.

Solve the given Lagrangian for c_{ii} and c_{ij}:

[53] E is the conditional expectation operator. Also, in period t=0 expectations for output in period t=1 are normalized to 1.

$$L = \left[\frac{C_i^{1-\sigma}}{1-\sigma}\right] + \lambda_i \left[P_i C_i - p_i c_{ii} - p_j c_{ij}\right] \qquad (4)$$

$$\frac{\partial U_i}{\partial c_{ii}} = \left[\frac{1}{1-\sigma}\right](1-\sigma) C_i^{-\sigma} \frac{\partial C_i}{\partial c_{ii}} + \lambda_i [-p_i] = 0$$

$$\frac{\partial U_i}{\partial c_{ij}} = \left[\frac{1}{1-\sigma}\right](1-\sigma) C_i^{-\sigma} \frac{\partial C_i}{\partial c_{ij}} + \lambda_i [-p_j] = 0$$

$$\frac{\partial U_i}{\partial \lambda_i} = [P_i C_i - p_i c_{ii} - p_j c_{ij}] = 0$$

Substitute for P_i and C_i.

$$C_i^{-\sigma} C_{i1}^{1/\varphi} a^{1/\varphi} c_{ii}^{-1/\varphi} = \lambda_i p_i \text{ and } C_i^{-\sigma} C_i^{1/\varphi} (1-a)^{1/\varphi} c_{ij}^{-1/\varphi} = \lambda_i p_j$$

Solve this for c_{ii} or c_{ij}:

$$\frac{a^{1/\varphi} c_{ii}^{-1/\varphi}}{(1-a)^{1/\varphi} c_{ij}^{-1/\varphi}} = \frac{\lambda_i p_i}{\lambda_i p_j}$$

Substitute into:

$$P_i C_i = p_i c_{ii} + p_j c_{ij}$$

Thus:

$$c_{ii} = a\left(\frac{p_i}{P_i}\right)^{-\varphi} C_i \quad \text{and} \quad c_{ij} = (1-a)\left(\frac{p_j}{P_i}\right)^{-\varphi} C_i \qquad (5)$$

The following equality represents resources constraint:

$$c_{ii} + c_{ji} = y_i \qquad (6)$$

Define:

$$q \equiv \frac{p_H}{p_F} \qquad (7)$$

Where q is the Home terms of trade: it is the relative price of the home good in terms of the foreign good.

The entire endowment is allocated to stocks. A country's holdings of domestic stock is denoted by S where $S=S_{ii}+S_{ji}=1$. The budget constraint for a household at time t=0 is: $p_s(S_{ii}+S_{ij})=p_s$ (with S_{ij} as country's i shares of stock j); and the market clearing condition for stocks: $S_{ii}+S_{ji}=1$. Thus, if S>1/2 then there is home bias in the stock market (also due to symmetry and because $S_{ii}+S_{ij}=1$ and $S_{ii}+S_{ji}=1$, under market clearing $S_{ij}= S_{ji}$ and thus $S_{ii}= S_{jj}$).

Use (5) and (6) for both countries:

$$c_{HH} + c_{FH} = y_H \text{ and } c_{FF} + c_{HF} = y_F \qquad (6a)$$

Substitute (5) into (6a) and solve:

$$a\left(\frac{p_H}{P_H}\right)^{-\varphi} C_H + (1-a)\left(\frac{p_H}{P_F}\right)^{-\varphi} C_F = y_H \quad \text{and} \quad a\left(\frac{p_F}{P_F}\right)^{-\varphi} C_F + (1-a)\left(\frac{p_F}{P_H}\right)^{-\varphi} C_H = y_F$$

$$1 + \frac{1-a}{a}\left(\frac{P_H}{P_F}\right)^{-\varphi}\left(\frac{C_F}{C_H}\right) = \frac{1}{a}\frac{1}{C_H}\left(\frac{p_H}{P_H}\right)^{\varphi} y_H \quad \text{and} \quad \left(\frac{P_H}{P_F}\right)^{-\varphi}\left(\frac{C_F}{C_H}\right) + \frac{1-a}{a} = \frac{1}{a}\frac{1}{C_H}\left(\frac{p_F}{P_H}\right)^{\varphi} y_F$$

Which gives:

$$\frac{1 + \frac{1-a}{a}\left(\frac{P_H}{P_F}\right)^{-\varphi}\left(\frac{C_F}{C_H}\right)}{\left(\frac{P_H}{P_F}\right)^{-\varphi}\left(\frac{C_F}{C_H}\right) + \frac{1-a}{a}} = \frac{y_H}{y_F}\left(\frac{p_H}{p_F}\right)^{\varphi} \quad \text{where} \quad q \equiv \frac{p_H}{p_F}$$

Thus, the following relationship is obtained:

$$q^{-\varphi}\Omega\left[\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)\right] = \frac{y_H}{y_F} \quad \text{where} \quad \Omega\left[\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)\right] = \frac{1 + \frac{1-a}{a}\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)}{\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right) + \frac{1-a}{a}} \qquad (8)$$

Now, given the budget constraint and the fact that household *i* holds S shares of the local stock and (1-S) shares of the foreign stock:

$$P_i C_i = S p_i y_i + (1-S) p_j y_j, \qquad (9)$$

where $p_i y_i$ is the dividend paid on the local stock, and $p_j y_j$ is what is paid on the foreign stock. Applying this property to two countries and solving for the difference in countries' consumption:

$$P_i C_i - P_j C_j = (2S - 1)\left(p_i y_i - p_j y_j\right) \qquad (10)$$

Again, $q \equiv \frac{p_H}{p_F}$ is the relative price of the home good in terms of the foreign good. Let $y = \frac{y_H}{y_F}$ represent the relative output. Log-linearize ($\hat{x} \equiv \log\frac{x}{\bar{x}}$) the model around the steady state (ss): $q \equiv \frac{p_H}{p_F} = 1, y = \frac{y_H}{y_F} = 1, \text{and } \frac{C_H}{C_F} = 1.$

Let $RER = \frac{P_F}{P_H}$ be the real exchange rate defined as domestic price of the foreign good.

Thus,

$$\widehat{RER} = \widehat{\left(\frac{P_F}{P_H}\right)} \qquad (11)$$

Use the price index (eq. (3)) and substitute it into eq. (11):

$$\begin{aligned}
\widehat{RER} = \widehat{\left(\frac{P_F}{P_H}\right)} &= d\log\frac{[a p_F^{1-\varphi} + (1-a)p_H^{1-\varphi}]^{1/(1-\varphi)}}{[a p_H^{1-\varphi} + (1-a)p_F^{1-\varphi}]^{1/(1-\varphi)}}|_{ss} \\
&= d\log\frac{p_F^{1-\varphi}[a + (1-a)q^{1-\varphi}]^{1/(1-\varphi)}}{p_F^{1-\varphi}[aq^{1-\varphi} + (1-a)]^{1/(1-\varphi)}}|_{ss} \\
&= d\left(\log[a + (1-a)q^{1-\varphi}]^{1/(1-\varphi)} - \log[\,aq^{1-\varphi} + (1-a)]^{1/(1-\varphi)}\right)|_{ss} \\
&= \frac{1}{1-\varphi}\left[\frac{(1-a)(1-\varphi)q^{-\varphi}dq}{[a + (1-a)q^{1-\varphi}]^{1/(1-\varphi)}} - \frac{a(1-\varphi)q^{-\varphi}dq}{[aq^{1-\varphi} + (1-a)]^{1/(1-\varphi)}}\right]|_{ss} \\
&= (1-a)dq - a\,dq = (1-2a)dq = -(2a-1)\hat{q} \qquad (12)
\end{aligned}$$

By Backus-Smith Condition (1993) the optimality condition is the following:

$$-\sigma\left(\widehat{C_F} - \widehat{C_H}\right) = \widehat{\left(\frac{P_F}{P_H}\right)} = -(2a-1)\hat{q} \qquad (13)$$

Provided that:

$$\frac{MU_F}{MU_H} = \frac{C_F^{-\sigma}}{C_H^{-\sigma}} \quad \text{and} \quad d\log\frac{MU_F}{MU_H} = d\log\frac{C_F^{-\sigma}}{C_H^{-\sigma}} = -\sigma(\widehat{C_F} - \widehat{C_H}),$$

Where MU represents the marginal utility of consumption. Thus, fluctuations in the real exchange rates are associated with the fluctuations in the aggregate consumption such that a decline in the real exchange rate (home currency appreciation) is related to the reduction in the relative consumption (the domestic consumption is more expensive, thus the domestic consumption falls relative to foreign), and vice versa.

Now, log-linearize eq. (8):

$$\text{If} \quad q^{-\varphi}\frac{1+\frac{1-a}{a}\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)}{\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)+\frac{1-a}{a}}=\frac{y_H}{y_F}=y \text{ and apply log transformation:}$$

$$-\varphi \log(q)+\log\left[1+\frac{1-a}{a}\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)\right]-\log\left[\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)+\frac{1-a}{a}\right]=\log(y)$$

$$\text{where } d\log(q)=\hat{q} \text{ and } d\log(y)=\hat{y}$$

$$\text{and } d\log\left[1+\frac{1-a}{a}\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)\right]=\frac{\frac{1-a}{a}\varphi\left(\frac{P_F}{P_H}\right)^{\varphi-1}\left(\frac{C_F}{C_H}\right)d\frac{P_F}{P_H}}{1+\frac{1-a}{a}\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)}+\frac{\frac{1-a}{a}\left(\frac{P_F}{P_H}\right)^{\varphi}d\frac{C_F}{C_H}}{1+\frac{1-a}{a}\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)}\Big|_{ss}$$

$$=(1-a)\varphi\widehat{\left(\frac{P_F}{P_H}\right)}+(1-a)\widehat{\left(\frac{C_F}{C_H}\right)}$$

$$\text{and } d\log\left[\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)+\frac{1-a}{a}\right]=\frac{\varphi\left(\frac{P_F}{P_H}\right)^{\varphi-1}\left(\frac{C_F}{C_H}\right)d\frac{P_F}{P_H}}{\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)+\frac{1-a}{a}}+\frac{\left(\frac{P_F}{P_H}\right)^{\varphi}d\frac{C_F}{C_H}}{\left(\frac{P_F}{P_H}\right)^{\varphi}\left(\frac{C_F}{C_H}\right)+\frac{1-a}{a}}\Big|_{ss}$$

$$=\varphi a\widehat{\left(\frac{P_F}{P_H}\right)}+a\widehat{\left(\frac{C_F}{C_H}\right)}$$

Thus,

$$-\varphi\hat{q}+(1-a)\varphi\widehat{\left(\frac{P_F}{P_H}\right)}+(1-a)\widehat{\left(\frac{C_F}{C_H}\right)}-\varphi a\widehat{\left(\frac{P_F}{P_H}\right)}-a\widehat{\left(\frac{C_F}{C_H}\right)}=\hat{y}$$

$$-\varphi\hat{q}+(1-2a)\varphi\widehat{\left(\frac{P_F}{P_H}\right)}+(1-2a)\widehat{\left(\frac{C_F}{C_H}\right)}=\hat{y}$$

And substituting equation (13) for $(\widehat{\frac{C_F}{C_H}})$:

$$-\varphi\hat{q} + (1 - 2a)\varphi\widehat{(\frac{P_F}{P_H})} + (1 - 2a)(-\frac{1}{\sigma})\widehat{(\frac{P_F}{P_H})} = \hat{y}$$

Gives:

$$-\varphi\hat{q} - (2a - 1)(\varphi - \frac{1}{\sigma})\widehat{(\frac{P_F}{P_H})} = \hat{y} \qquad (14)$$

$$\text{Set} \quad \lambda = \varphi + (2a - 1)(\varphi - \frac{1}{\sigma})[-(2a - 1)] = [1 - (2a - 1)^2]\varphi + \frac{1}{\sigma}(2a - 1)^2$$

Thus $\hat{y} = -\lambda\hat{q}$ where λ represents trade elasticity of relative output.

The representative household in country *i* holds S shares of the local stock and (1-S) of the foreign stock, which pay respectively $p_H y_H$ and $p_F y_F$.

Thus, the relative equity return is:

$$\text{Re} = \frac{p_H y_H}{p_F y_F} \qquad (15)$$

Log-linearizing:

$$\widehat{\text{Re}} = \hat{q} + \hat{y} = (1 - \lambda)\hat{q} \qquad (16)$$

This implies that for $\lambda>1$, an increase in relative equity returns is associated with worsening of Home's terms of trade; and for $\lambda<1$, an increase in relative equity returns is associated with an improvement in the terms of trade.

Log-linearize (10):

$$P_H C_H - P_F C_F = (2S - 1)(p_H y_H - p_F y_F) \qquad (10)$$

$$\begin{aligned}\widehat{P_H C_H} - \widehat{P_F C_F} &= (2S - 1)d\log(p_H y_H - p_F y_F) = (2S - 1)d\left(\log\frac{p_H y_H}{p_F y_F}\right) \\ &= (2S - 1)d\left(\log\frac{p_H}{p_F} + \log\frac{y_H}{y_F}\right) = (2S - 1)(\hat{q} + \hat{y}) \\ &= (2S - 1)(1 - \lambda)\hat{q} \qquad (17[\text{by } (16)])\end{aligned}$$

Also (by (13)):

$$\mathrm{Log}(P_H C_H - P_F C_F) = \log\frac{P_H C_H}{P_F C_F} = -\log\frac{P_F C_F}{P_H C_H} = -\log\frac{P_F}{P_H} - \log\frac{C_F}{C_H}$$

$$\mathrm{dLog}(P_H C_H - P_F C_F) = -\mathrm{dlog}\frac{P_F}{P_H} - \mathrm{dlog}\frac{C_F}{C_H} = -\widehat{(\frac{P_F}{P_H})} - \left(\widehat{C_F} - \widehat{C_H}\right) = -\widehat{(\frac{P_F}{P_H})} - \left(-\frac{1}{\sigma}\right)\widehat{(\frac{P_F}{P_H})}$$

$$= \left(1 - \frac{1}{\sigma}\right)(2a - 1)\hat{q} \qquad (18)$$

Using (17) and (18):

$$(2S - 1)(1 - \lambda)\hat{q} = \left(1 - \frac{1}{\sigma}\right)(2a - 1)\hat{q}$$

Thus, by eq. (13):

$$S = \frac{1}{2}\left[\frac{\left(1 - \frac{1}{\sigma}\right)(2a - 1)}{(1 - \lambda)} + 1\right] \qquad (19)$$

Thus $\left[\frac{\left(1 - \frac{1}{\sigma}\right)(2a - 1)}{(1 - \lambda)}\right]$ is the hedge component:

$$\widehat{Re} = (1 - \lambda)\hat{q} \text{ then } \mathrm{var}\left(\widehat{Re}\right) = (1 - \lambda)^2\,\mathrm{var}(\hat{q})$$

$$\widehat{RER} = -(2a - 1)\hat{q} \text{ then } \mathrm{cov}\left(\widehat{Re}, \widehat{RER}\right) = -(1 - \lambda)(2a - 1)\mathrm{var}(\hat{q})$$

$$\frac{\mathrm{cov}\left(\widehat{Re}, \widehat{RER}\right)}{\mathrm{var}\left(\widehat{Re}\right)} = \frac{-(1 - \lambda)(2a - 1)\mathrm{var}(\hat{q})}{(1 - \lambda)^2\,\mathrm{var}(\hat{q})} = -\frac{(2a - 1)}{(1 - \lambda)}$$

$$\left[-\frac{\left(1 - \frac{1}{\sigma}\right)(2a - 1)}{(1 - \lambda)}\right] = \left(1 - \frac{1}{\sigma}\right)\frac{\mathrm{cov}(\widehat{Re}, \widehat{RER})}{\mathrm{var}(\widehat{Re})}$$

Which represents stock portfolio holdings in equilibrium, provided $\sigma \neq 0$ and $\lambda \neq 1$. Eq. (19) implies that changes in the aggregate consumption are related to the changes in the real exchange

rate. More specifically, it implies that hedging real exchange rate risk can be used to smooth consumption.

Thus:

$$S = \frac{1}{2}\left[1 - \left(1 - \frac{1}{\sigma}\right)\frac{\operatorname{cov}\left(\widehat{Re}, \widehat{RER}\right)}{\operatorname{var}\left(\widehat{Re}\right)}\right] \qquad (20)$$

This relationship implies that when the covariance-variance ratio is negative, then S>1/2, and there is home bias in equity portfolio allocations. However, if the covariance-variance ratio is positive, then S<1/2, and there is foreign bias in equity positions.

Thus,

$$\frac{\operatorname{cov}(\widehat{Re}, \widehat{RER})}{\operatorname{var}(\widehat{Re})} = \operatorname{corr}\left(\widehat{Re}, \widehat{RER}\right) * \frac{\sqrt{\operatorname{var}(\widehat{RER})}}{\sqrt{\operatorname{var}(\widehat{Re})}} = \frac{2a - 1}{1 - \lambda}\operatorname{corr}\left(\widehat{Re}, \widehat{RER}\right)$$

Therefore the optimal portfolio position is:

$$S = \frac{1}{2}\left[1 - \left(1 - \frac{1}{\sigma}\right)\frac{\sqrt{\operatorname{var}\left(\widehat{RER}\right)}}{\sqrt{\operatorname{var}\left(\widehat{Re}\right)}}\operatorname{corr}\left(\widehat{Re}, \widehat{RER}\right)\right] \qquad (21)$$

In this particular model, the correlation between the real exchange rates and the relative returns is equal to -1 since there is only a supply shock, and no demand shocks. In a more realistic setting, there are both supply and demand shocks and the correlation would not be equal to -1, however, it would have the same sign as the covariance-variance ratio. Thus, one would expect this kind of a relationship (eq. (21)) to hold in a more complex model with supply and demand shocks, nevertheless, this assumption cannot be confirmed within this investigation. Moreover, using correlation, and not covariance makes this relationship easier to interpret. Thus, for the empirical testing in this paper, the correlation between the real exchange rates and relative returns is utilized into the model and not the covariance-variance ratio.

APPENDIX II: COUNTRIES

Source Countries:

Australia, Austria, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Luxembourg, Malaysia, Netherlands, New Zealand, Norway, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, United Kingdom, United States.

Destination Countries:

Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Colombia, Denmark, Finland, France, Germany, Greece, Hong Kong, Indonesia, Ireland, Israel, Italy, Japan, Luxembourg, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Norway, Peru, Philippines, Portugal, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, United Kingdom, United States.

Small Sample:

Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Netherlands, Norway, South Africa, Spain, Sweden, Switzerland, United Kingdom, United States.

APPENDIX III: CONVERSION RATES FOR THE EURO ZONE

Austria	13.7603 Australian Shilling
Belgium	40.3399 Belgian Franc
Finland	5.9457 Finnish Markka
France	6.5596 French Franc
Germany	1.9558 Deutsche Mark
Ireland	0.7876 Irish Pound
Italy	1,936.27 Italian Lira
Luxembourg	40.3399 Belgian Franc
Netherlands	2.2037 Dutch Guilder
Portugal	200.482 Portuguese Escudo
Spain	166.386 Spanish Peseta
Greece	340.750 Greek Drachma

APPENDIX IV: REPLICATED RESULTS

Table 5: Gravity Model for Equity Holdings: OLS Estimation.

$Log(Equity_{ijt})$						
	(1)	(2)	(3)	(4)	(5)	(6)
$Log(MktCap_{it}*MktCap_{jt})$	1.089*** (.021)	1.043*** (.020)	1.042*** (.020)	1.217*** (.024)	.971*** (.021)	
$Correlation_{ijt}$	6.288*** (.271)	2.046*** (.276)	1.784*** (.280)	2.014*** (.252)	1.659*** (.276)	.248 (.316)
$ExpRet_{jt}$		.667*** (.216)	.658*** (.216)	.274 (.171)	.081 (.189)	-.292* (.168)
$Log[(Gdp/Cap)_{it}*(Gdp/Cap)_{jt}]$		.842*** (.037)	.839*** (.037)	.005 (.038)	2.280*** (.048)	.482** (.218)
$Log(Distance)_{ij}$		-.724*** (.050)	-.771*** (.052)	-.187*** (.054)	-.303*** (.050)	-.341*** (.062)
$Border_{ij}$		-.256 (.162)	-.499*** (.167)	-.131 (.132)	-.279** (.140)	-.124 (.123)
$Log[(Exp_{ijt}+Imp_{ijt})/(Gdp_{it}*Gdp_{jt})]$		.271*** (.036)	.230*** (.037)	.524*** (.039)	.464*** (.034)	.553*** (.045)
$Currency_{ijt}$			.083 (.123)	.173 (.107)	.122 (.112)	.512*** (.112)
$LegalSystem_{ij}$			.135 (.085)	.329*** (.069)	.250*** (.071)	.387*** (.064)
$Language_{ij}$			.550*** (.133)	.222** (.108)	.712*** (.114)	.014 (.103)
Source Country Dummies	No	No	No	Yes	No	Yes
Destination Country Dummies	No	No	No	No	Yes	Yes
Number of Observations	4166	4160	4160	4160	4160	4160
R^2	.582	.673	.675	.806	.788	.845

All regressions include regional and period fixed effects:
(4) with source country dummies.
(5) with destination country dummies.
(6) with source and destination country dummies.
Standard errors are in parenthesis.
Statistical significance at 1%, 5% and 10% is denoted by ***, **, and *.

Table 6: Gravity Model for Equity Holdings: OLS Estimation – Small Sample.

$Log(Equity_{ijt})$						
	(1)	(2)	(3)	(4)	(5)	(6)
$Log(MktCap_{it}*MktCap_{jt})$	.891*** (.019)	.941*** (.021)	.921*** (.020)	1.256*** (.026)	.802*** (.022)	
$Correlation_{ijt}$	4.521*** (.254)	2.339*** (.265)	1.978*** (.258)	1.417*** (.248)	2.142*** (.279)	1.987*** (.338)
$ExpRet_{jt}$		-1.625*** (.329)	-1.764*** (.316)	.563** (.282)	-.842** (.338)	-.691** (.274)
$Log[(Gdp/Cap)_{it}*(Gdp/Cap)_{jt}]$		1.202*** (.099)	1.528*** (.101)	.495*** (.105)	2.249*** (.114)	.130 (.251)
$Log(Distance)_{ij}$		-.364*** (.043)	-.335*** (.044)	-.053 (.051)	-.262*** (.043)	.093 (.060)
$Border_{ij}$		.452*** (.107)	.031 (.112)	.111 (.092)	.091 (.106)	.093 (.094)
$Log[(Exp_{ijt}+Imp_{ijt})/(Gdp_{it}*Gdp_{jt})]$		.066* (.034)	.007 (.034)	.352*** .039	.023 (.035)	.491*** (.049)
$Currency_{ijt}$			.842*** (.102)	.430*** (.092)	.686*** (.098)	.353*** (.098)
$LegalSystem_{ij}$			.442*** (.079)	.417*** (.063)	.475*** (.073)	.397*** (.062)
$Language_{ij}$			.197** (.098)	.036 (.082)	.220** (.096)	-.022 (.085)
Source Country Dummies	No	No	No	Yes	No	Yes
Destination Country Dummies	No	No	No	No	Yes	Yes
Number of Observations	1484	1481	1481	1481	1481	1481
R^2	.678	.759	.779	.867	.821	.883

All regressions include regional and period fixed effects:
(4) with source country dummies.
(5) with destination country dummies.
(6) with source and destination country dummies.
Standard errors are in parenthesis.
Statistical significance at 1%, 5% and 10% is denoted by ***, **, and *.

Table 7: First Stage Regression.

	$Correlation_{ijt}$
$Correlation_{ij}$ 1970-1980	.140*** (.028)
$Log(Distance)_{ij}$	-.059*** (.028)
$Border_{ij}$	-.046*** (.012)
$Legal\ System_{ij}$	.054*** (.008)
$Language_{ij}$	.015 (.012)
Number of observations	1524
R^2	.335

Standard errors are in parenthesis.
Statistical significance at 1%, 5% and 10% is denoted by ***, **, and *.

Table 8: Gravity Model for Equity Holdings using Instrumented Stock Return Correlations.

$Log(Equity_{ijt})$				
	(1)	(2)	(3)	(4)
$Log(MktCap_{it}*MktCap_{jt})$	.972*** (.020)	1.303*** (.025)	.844*** (.022)	
$IV\text{-}Correlation_{ijt}$	.987 (2.019)	2.114 (1.801)	3.511* (2.122)	3.512 (2.206)
$ExpRet_{jt}$	-1.592*** (.323)	.779*** (.286)	-.784** (.342)	-.668** (.275)
$Log[(Gdp/Cap)_{it}*(Gdp/Cap)_{jt}]$	1.557*** (.104)	.604*** (.102)	2.151*** (.120)	.323 (.249)
$Log(Distance)_{ij}$	-.395*** (.131)	.017 (.125)	-.214 (.136)	.145 (.153)
$Border_{ij}$	-.050 (.153)	.093 (.129)	.150 (.153)	.152 (.144)
$Log[(Exp_{ijt}+Imp_{ijt})/(Gdp_{it}*Gdp_{jt})]$	.026 (.037)	.394*** (.039)	.006 (.037)	.478*** (.049)
$Currency_{ijt}$	.870*** (.106)	.525*** (.093)	.682*** (.102)	.468*** (.097)
$LegalSystem_{ij}$	.487*** (.127)	.350*** (.112)	.353** (.131)	.234* (.135)
$Language_{ij}$	.243* (.127)	.025 (.105)	.173 (.124)	-.073 (.110)
Source Country Dummies	No	Yes	No	Yes
Destination Country Dummies	No	No	Yes	Yes
Number of Observations	1487	1487	1487	1487
R^2	.789	.875	.831	.892

All regressions include regional and period fixed effects:
(2) with source country dummies.
(3) with destination country dummies.
(4) with source and destination country dummies.
Standard errors are in parenthesis.
Statistical significance at 1%, 5% and 10% is denoted by ***, **, and *.

Table 9: Summary Statistics 2001 – 2005.

Descriptive statistics is provided for each source country. Averages are calculated across all destination countries and all periods. Equity: source country equity holdings in a destination country. Distance: distance between a source and a destination country. EX + IM: the sum of exports and imports between a source and a destination country. Correlations: bilateral stock market correlations for pairs of source and destination countries for period 2001-2005. Corr1970-80: bilateral stock market correlations for period 1970-1980.

SOURCE COUNTRIES	VARIABLE	Mean	Std.Dev	Min	Max	No Obs
Australia	Equity	2918.2	10068.0	0.0	71270.9	29.6
	Distance	13181	4276	2151	18186	40
	EX+IM	3283.0	5434.1	1.9	34528.9	37.8
	Correlations	0.50	0.13	0.00	0.71	36.6
	Corr1970-80	0.37	0.10	0.21	0.61	17
Austria	Equity	1018.6	2258.7	0.0	12897.7	40
	Distance	5862	4809	525	17851	40
	EX+IM	3752.3	11657.8	15.9	91495.5	39
	Correlations	0.38	0.13	0.08	0.63	36.6
	Corr1970-80	0.36	0.14	0.14	0.60	17
Belgium	Equity	3535.1	10999.7	0.0	84174.2	40
	Distance	5845	4975	171	18277	40
	EX+IM	11507.2	22332.1	123.8	119777.5	39
	Correlations	0.39	0.19	0.01	0.79	36.6
	Corr1970-80	0.52	0.13	0.35	0.76	17
Canada	Equity	6837.2	24741.5	0.0	194236.7	39.6
	Distance	8523	3656	558	15803	40
	EX+IM	12946.2	64237.5	104.3	479975.5	39
	Correlations	0.52	0.13	-0.04	0.80	36.6
	Corr1970-80	0.39	0.14	0.22	0.70	17
Chile	Equity	286.1	1338.6	0.0	13803.9	40
	Distance	11757	4261	1129	18598	40
	EX+IM	918.0	1566.2	0.0	11303.2	40
	Correlations	0.44	0.11	0.02	0.71	36.6
	Corr1970-80					
Denmark	Equity	1366.7	2962.1	0.0	21953.2	40
	Distance	5870	4796	361	17526	40
	EX+IM	2761.2	4986.6	28.5	29866.3	39
	Correlations	0.43	0.16	0.12	0.71	36.6
	Corr1970-80	0.38	0.08	0.25	0.51	17

Table 9: Summary Statistics 2001 – 2005.

Descriptive statistics is provided for each source country. Averages are calculated across all destination countries and all periods. Equity: source country equity holdings in a destination country. Distance: distance between a source and a destination country. EX + IM: the sum of exports and imports between a source and a destination country. Correlations: bilateral stock market correlations for pairs of source and destination countries for period 2001-2005. Corr1970-80: bilateral stock market correlations for period 1970-1980.

SOURCE COUNTRIES	VARIABLE	Mean	Std.Dev	Min	Max	No Obs
Finland	Equity	1391.6	2153.0	0.0	10002.0	26.2
	Distance	6087	4468	396	16654	40
	EX+IM	1819.7	2955.9	15.2	16501.1	39
	Correlations	0.36	0.16	-0.14	0.68	36.6
	Corr1970-80					
France	Equity	8107.4	14987.7	0.0	69843.2	39.6
	Distance	5892	4990	266	18542	40
	EX+IM	15809.0	26895.0	196.4	154180.8	39
	Correlations	0.51	0.19	0.03	0.90	36.6
	Corr1970-80	0.46	0.11	0.29	0.66	17
Germany	Equity	10873.4	27941.9	-1356.5	216241.4	40
	Distance	5828	4851	361	17747	40
	EX+IM	27751.2	37245.1	423.6	167686.1	39
	Correlations	0.51	0.18	0.13	0.90	36.6
	Corr1970-80	0.44	0.15	0.29	0.72	17
Greece	Equity	135.4	372.0	0.0	2406.6	30.6
	Distance	6184	4457	562	17467	40
	EX+IM	997.7	1690.2	5.3	9103.9	39
	Correlations	0.34	0.11	0.11	0.58	36.6
	Corr1970-80					
Hong Kong	Equity	2261.7	6534.3	0.0	48144.8	30
	Distance	9301	4727	769	18598	40
	EX+IM	5987.7	11235.9	32.2	61877.2	38
	Correlations	0.43	0.14	-0.08	0.76	36.6
	Corr1970-80	0.32	0.10	0.18	0.55	17
Ireland	Equity	5950.0	14861.5	-220.3	99779.0	37.8
	Distance	6086	4842	469	18163	40
	EX+IM	3660.6	7863.7	9.8	45345.2	39
	Correlations	0.44	0.14	0.14	0.74	36.6
	Corr1970-80					

Table 9: Summary Statistics 2001 – 2005.

Descriptive statistics is provided for each source country. Averages are calculated across all destination countries and all periods. Equity: source country equity holdings in a destination country. Distance: distance between a source and a destination country. EX + IM: the sum of exports and imports between a source and a destination country. Correlations: bilateral stock market correlations for pairs of source and destination countries for period 2001-2005. Corr1970-80: bilateral stock market correlations for period 1970-1980.

SOURCE COUNTRIES	VARIABLE	Mean	Std.Dev	Min	Max	No Obs
Italy	Equity	7690.9	25205.5	0.0	205334.8	40
	Distance	5983	4796	692	18389	40
	EX+IM	11706.8	19640.6	262.0	113534.6	39
	Correlations	0.40	0.15	0.06	0.79	36.6
	Corr1970-80	0.29	0.08	0.18	0.42	17
Japan	Equity	6710.8	24122.3	0.0	192603.8	40
	Distance	9488	3951	1153	18531	40
	EX+IM	15350.7	30610.3	166.1	201459.5	39
	Correlations	0.34	0.11	0.01	0.58	36.6
	Corr1970-80	0.37	0.11	0.07	0.50	17
Luxembourg	Equity	11574.5	22705.3	1.7	159160.4	40
	Distance	5832	4976	190	18320	40
	EX+IM	547.8	1305.4	0.2	6501.8	39
	Correlations					
	Corr1970-80					
Malaysia	Equity	32.9	90.1	0.0	639.5	30.4
	Distance	9667	4651	300	19034	40
	EX+IM	4250.8	8204.3	7.5	42634.0	38
	Correlations	0.32	0.13	-0.08	0.61	36.6
	Corr1970-80					
Netherlands	Equity	8046.3	23372.7	0.0	195483.4	40
	Distance	5847	4945	171	18114	40
	EX+IM	11138.6	21257.1	134.4	138660.5	39
	Correlations	0.52	0.18	0.15	0.87	36.6
	Corr1970-80	0.53	0.12	0.34	0.77	17
New Zealand	Equity	723.6	1650.4	0.1	8600.1	17.2
	Distance	14094	4478	2151	19626	40
	EX+IM	755.7	1559.3	5.2	10112.8	39
	Correlations	0.44	0.10	0.06	0.71	36.6
	Corr1970-80					

Table 9: Summary Statistics 2001 – 2005.

Descriptive statistics is provided for each source country. Averages are calculated across all destination countries and all periods. Equity: source country equity holdings in a destination country. Distance: distance between a source and a destination country. EX + IM: the sum of exports and imports between a source and a destination country. Correlations: bilateral stock market correlations for pairs of source and destination countries for period 2001-2005. Corr1970-80: bilateral stock market correlations for period 1970-1980.

SOURCE COUNTRIES	VARIABLE	Mean	Std.Dev	Min	Max	No Obs
Norway	Equity	1996.3	4715.9	0.0	40302.8	37.8
	Distance	5992	4659	417	17202	40
	EX+IM	2709.8	4698.9	0.0	30021.3	39
	Correlations	0.49	0.13	0.11	0.70	36.6
	Corr1970-80	0.35	0.12	0.07	0.59	17
Portugal	Equity	377.3	963.3	0.0	7540.4	35.6
	Distance	6446	4899	501	19626	40
	EX+IM	1739.0	3842.6	8.1	27609.7	39
	Correlations	0.40	0.17	0.02	0.72	36.8
	Corr1970-80					
Singapore	Equity	1189.5	2279.8	0.2	15126.2	34
	Distance	9816	4680	300	19302	40
	EX+IM	5894.2	10812.1	0.0	57724.0	39
	Correlations	0.44	0.14	-0.11	0.76	36.6
	Corr1970-80	0.39	0.10	0.16	0.55	17
South Africa	Equity	1257.0	4758.0	0.0	37064.2	28.8
	Distance	9484	2065	4508	14580	40
	EX+IM	1358.0	2115.1	16.6	11228.2	39
	Correlations	0.43	0.11	0.12	0.69	30
	Corr1970-80					
Spain	Equity	2087.0	4914.8	0.0	40394.3	39
	Distance	6241	4939	501	19589	40
	EX+IM	7904.5	14306.7	149.3	79219.5	39
	Correlations	0.51	0.15	0.12	0.81	36.6
	Corr1970-80	0.27	0.06	0.16	0.39	17
Sweden	Equity	3677.6	8888.1	0.0	53887.1	38.2
	Distance	5990	4609	396	17000	40
	EX+IM	4158.7	6219.8	39.7	33738.6	39
	Correlations	0.49	0.16	0.06	0.84	36.6
	Corr1970-80	0.36	0.08	0.23	0.53	17

Table 9: Summary Statistics 2001 – 2005.

Descriptive statistics is provided for each source country. Averages are calculated across all destination countries and all periods. Equity: source country equity holdings in a destination country. Distance: distance between a source and a destination country. EX + IM: the sum of exports and imports between a source and a destination country. Correlations: bilateral stock market correlations for pairs of source and destination countries for period 2001-2005. Corr1970-80: bilateral stock market correlations for period 1970-1980.

SOURCE COUNTRIES	VARIABLE	Mean	Std.Dev	Min	Max	No Obs
Switzerland	Equity	6621.1	16835.5	0.1	104249.4	35.2
	Distance	5849	4947	304	18388	40
	EX+IM	4554.3	9250.9	45.7	62325.5	39
	Correlations	0.42	0.16	0.11	0.76	36.6
	Corr1970-80	0.51	0.13	0.27	0.77	17
United Kingdom	Equity	17019.2	34495.2	-11520.7	269995.6	38.4
	Distance	5926	4951	321	18331	40
	EX+IM	15631.9	22344.3	283.6	105855.0	39
	Correlations	0.49	0.17	0.13	0.81	36.6
	Corr1970-80	0.42	0.11	0.22	0.60	17
United States	Equity	48715.9	86673.6	16.0	537891.0	39
	Distance	8489	3838	558	16179	40
	EX+IM	41868.2	77601.2	549.3	492624.8	39
	Correlations	0.50	0.15	0.03	0.80	36.6
	Corr1970-80	0.39	0.14	0.14	0.70	17

APPENDIX V: OLS ESTIMATION WITH $\mathbf{CORR}(\widehat{\mathbf{RER}}, \widehat{\mathbf{Re}})$

Table 10: Gravity Model for Equity Holdings: OLS Estimation with $\mathbf{corr}(\widehat{\mathbf{RER}}, \widehat{\mathbf{Re}})$.

Log($Equity_{ijt}$)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Log(MktCap_{it} * MktCap_{jt})$	1.339*** (.018)	1.155*** (.019)	1.100*** (.019)	1.092*** (.019)	1.242*** (.023)	1.056*** (.019)	
$Correlation_{ijt}$		6.196*** (.233)	1.927*** (.241)	1.829*** (.241)	1.346*** (.225)	2.007*** (.245)	-.342 (.278)
$corr(\widehat{RER}, \widehat{Re})_{ijt}$	1.591*** (.174)	.664*** (.168)	-1.101*** (.157)	-1.520*** (.171)	-.254* (.151)	-1.642*** (.184)	.364* (.191)
$ExpRet_{jt}$			-.092 (.160)	-.089 (.160)	-.401*** (.130)	.147 (.144)	-.449*** (.126)
$Log[(Gdp/Cap)_{it} * (Gdp/Cap)_{jt}]$			.726*** (.033)	.763*** (.034)	-.035 (.036)	2.060*** (.044)	1.480*** (.171)
$Log(Distance)_{ij}$			-.875*** (.045)	-.847*** (.045)	-.268*** (.047)	-.394*** (.046)	-.396*** (.056)
$Border_{ij}$			-.134 (.131)	-.277** (.138)	-.023 (.114)	-.150 (.121)	-.146 (.109)
$Log[(Exp_{ijt}+Imp_{ijt}) / (Gdp_{it}*Gdp_{jt})]$			.250*** (.029)	.243*** (.030)	.545*** (.034)	.507*** (.028)	.609*** (.039)
$Currency_{ijt}$				.569*** (.102)	.624*** (.090)	.469*** (.099)	.806*** (.098)
$LegalSystem_{ij}$				.140** (.069)	.258*** (.059)	.219*** (.060)	.271*** (.056)
$Language_{ij}$				.131 (.122)	.085 (.101)	.250** (.107)	-.025 (.097)
Source Country Dummies	No	No	No	No	Yes	No	Yes
Destination Country Dummies	No	No	No	No	No	Yes	Yes
Number of Observations	5687	5687	5684	5684	5684	5684	5684
R^2	.565	.613	.696	.699	.805	.784	.837

All regressions include regional and period fixed effects:
(5) with source country dummies.
(6) with destination country dummies.
(7) with source and destination country dummies.
Standard errors are in parenthesis.
Statistical significance at 1%, 5% and 10% is denoted by ***, **, and *.

Table 11: Summary Statistics 2001-2008.

Descriptive statistics is provided for each source country. Averages are calculated across all destination countries and all periods. Equity: source country equity holdings in a destination country. Distance: distance between a source and a destination country. EX + IM: the sum of exports and imports between a source and a destination country. Correlations: bilateral stock market correlations for pairs of source and destination countries for period 2001-2008. Corr(RER, Re): bilateral correlations between real exchange rate fluctuations and relative excess returns.

SOURCE COUNTRIES	VARIABLE	Mean	Std.Dev	Min	Max	No Obs
Austria	Equity	1284.6	3025.9	0.0	23434.4	40
	EX+IM	4593.0	14669.6	15.9	129430.9	39
	Correlations	0.42	0.14	0.08	0.84	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.30	0.23	-0.69	0.17	32.8
Belgium	Equity	4642.9	15495.7	0.0	151498.6	39.6
	EX+IM	14124.5	28323.4	123.8	173576.4	39
	Correlations	0.43	0.20	0.01	0.86	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.30	0.23	-0.71	0.19	32.8
Canada	Equity	8621.8	30538.1	0.0	286769.1	39.8
	EX+IM	14912.6	72643.5	104.3	568695.1	39
	Correlations	0.53	0.15	-0.04	0.81	36.8
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.40	0.15	-0.77	0.08	32.8
Chile	Equity	607.5	2903.1	0.0	28752.3	40
	EX+IM	1372.8	2441.0	3.9	19328.9	39
	Correlations	0.48	0.12	0.02	0.74	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.35	0.13	-0.70	0.13	32.8
Denmark	Equity	1914.9	4230.5	0.0	36122.6	40
	EX+IM	3339.7	6270.2	28.5	43755.3	39
	Correlations	0.47	0.17	0.12	0.82	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.27	0.20	-0.71	0.14	32.8
Finland	Equity	1935.9	3291.7	0.0	20206.0	27.3
	EX+IM	2270.2	3869.2	15.2	24129.5	39
	Correlations	0.37	0.16	-0.14	0.69	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.15	0.16	-0.55	0.26	32.8

Table 11: Summary Statistics 2001-2008.

Descriptive statistics is provided for each source country. Averages are calculated across all destination countries and all periods. Equity: source country equity holdings in a destination country. Distance: distance between a source and a destination country. EX + IM: the sum of exports and imports between a source and a destination country. Correlations: bilateral stock market correlations for pairs of source and destination countries for period 2001-2008. Corr(RER, Re): bilateral correlations between real exchange rate fluctuations and relative excess returns.

SOURCE COUNTRIES	VARIABLE	Mean	Std.Dev	Min	Max	No Obs
France	Equity	10768.0	20879.2	0.0	138614.6	39.6
	EX+IM	18760.3	32748.0	196.4	211305.3	39
	Correlations	0.54	0.19	0.03	0.94	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.28	0.21	-0.75	0.20	32.8
Germany	Equity	14330.3	45015.4	-1356.5	438445.8	40
	EX+IM	34113.9	47823.3	423.6	243622.1	39
	Correlations	0.54	0.18	0.13	0.94	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.27	0.19	-0.68	0.18	32.8
Greece	Equity	241.3	827.8	0.0	6524.3	32.1
	EX+IM	1218.8	2115.5	5.3	12514.2	39
	Correlations	0.38	0.13	0.11	0.73	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.14	0.21	-0.70	0.26	32.8
Hong Kong	Equity	2474.4	7084.9	0.0	51650.0	33.4
	EX+IM	6716.3	12203.3	32.2	65769.0	38.3
	Correlations	0.45	0.14	-0.08	0.77	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.19	0.17	-0.72	0.31	32.8
Ireland	Equity	9171.6	20678.9	-220.3	147762.0	35.1
	EX+IM	4061.8	8772.1	9.8	56333.1	39
	Correlations	0.46	0.14	0.14	0.76	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.20	0.22	-0.65	0.21	8.8
Italy	Equity	8999.8	34113.4	0.0	347044.4	40
	EX+IM	13916.8	23730.2	262.0	157741.9	39
	Correlations	0.44	0.17	0.06	0.88	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.34	0.18	-0.72	0.16	32.8

Table 11: Summary Statistics 2001-2008.

Descriptive statistics is provided for each source country. Averages are calculated across all destination countries and all periods. Equity: source country equity holdings in a destination country. Distance: distance between a source and a destination country. EX + IM: the sum of exports and imports between a source and a destination country. Correlations: bilateral stock market correlations for pairs of source and destination countries for period 2001-2008. Corr(RER, Re): bilateral correlations between real exchange rate fluctuations and relative excess returns.

SOURCE COUNTRIES	VARIABLE	Mean	Std.Dev	Min	Max	No Obs
Japan	Equity	8171.5	27527.2	0.0	224136.0	40
	EX+IM	17374.5	33063.5	166.1	217732.7	39
	Correlations	0.36	0.12	0.01	0.66	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.44	0.11	-0.79	-0.08	32.8
Malaysia	Equity	103.6	325.6	0.0	2883.6	30.9
	EX+IM	5073.7	9565.7	7.5	49031.3	38
	Correlations	0.33	0.13	-0.08	0.61	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.44	0.12	-0.70	-0.01	32.8
Netherlands	Equity	9776.0	27361.5	0.0	227218.6	40
	EX+IM	13837.5	27725.9	134.4	221065.6	39
	Correlations	0.55	0.18	0.15	0.92	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.26	0.23	-0.70	0.23	32.8
Norway	Equity	3164.2	7276.4	0.0	64507.8	38
	EX+IM	3551.7	6754.7	0.0	51962.6	39
	Correlations	0.52	0.14	0.11	0.83	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.38	0.14	-0.74	0.04	32.8
Portugal	Equity	587.4	1568.0	0.0	11722.3	37.3
	EX+IM	2118.6	4973.4	8.1	40487.0	39
	Correlations	0.43	0.17	0.02	0.80	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.26	0.23	-0.74	0.20	32.8
Singapore	Equity	1684.5	3414.0	0.2	24676.0	34.4
	EX+IM	7615.5	13798.4	14.1	78903.1	38.8
	Correlations	0.46	0.15	-0.11	0.77	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.42	0.14	-0.71	0.03	32.8

Table 11: Summary Statistics 2001-2008.

Descriptive statistics is provided for each source country. Averages are calculated across all destination countries and all periods. Equity: source country equity holdings in a destination country. Distance: distance between a source and a destination country. EX + IM: the sum of exports and imports between a source and a destination country. Correlations: bilateral stock market correlations for pairs of source and destination countries for period 2001-2008. Corr(RER, Re): bilateral correlations between real exchange rate fluctuations and relative excess returns.

SOURCE COUNTRIES	VARIABLE	Mean	Std.Dev	Min	Max	No Obs
South Africa	Equity	1436.1	5346.4	0.0	37064.2	30.3
	EX+IM	1826.7	2882.1	16.6	16478.0	39
	Correlations	0.47	0.12	0.12	0.80	33
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.46	0.10	-0.79	-0.12	29.3
Spain	Equity	2665.8	6933.6	-1.4	60597.2	39.4
	EX+IM	9639.0	17334.5	149.3	101101.5	39
	Correlations	0.54	0.16	0.12	0.87	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.28	0.20	-0.74	0.18	32.8
Sweden	Equity	4527.6	10401.2	0.0	70019.9	38.9
	EX+IM	5102.9	7934.5	39.7	48712.9	39
	Correlations	0.52	0.16	0.06	0.88	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.35	0.14	-0.66	0.10	32.8
Switzerland	Equity	7173.6	18513.2	0.0	134893.3	36.9
	EX+IM	5508.4	11630.4	45.7	95572.6	39
	Correlations	0.46	0.17	0.11	0.82	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.39	0.17	-0.76	0.05	32.8
United Kingdom	Equity	20585.0	43179.2	-11520.7	361441.0	39
	EX+IM	18096.9	26289.7	283.6	137887.4	39
	Correlations	0.53	0.17	0.13	0.86	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.38	0.16	-0.76	0.05	32.8
United States	Equity	63384.2	108888.0	16.0	714928.0	39
	EX+IM	47603.7	88081.0	549.3	588284.4	39
	Correlations	0.53	0.15	0.03	0.82	37.1
	$\mathrm{corr}(\widehat{\mathrm{RER}}, \widehat{\mathrm{Re}})$	-0.39	0.17	-0.80	0.31	32.8